APPENDIX D7.1

AQUATIC BIODIVERSITY COMPLIANCE REPORT

AQUATIC BIODIVERSITY

COMPLIANCE REPORT

PROPOSED ACORN CITY MIXED USE TOWNSHIP DEVELOPMENT

Specialist Aquatic Biodiversity Compliance Assessment for the proposed development of a mixed township on Portion 27 of the farm Arthursseat 214-KU in the Bushbuck Ridge Municipality, Mpumalanga

Dr Andrew Deacon (PhD Zoology)

Registered with the South African Council for Natural Scientific Professions

(Registration number: 116951)

December 2021

Dr Andrew Deacon

Environmental Ecologist

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25/11/2021

To: Eco-8 Environmental Planners

By E-mail: eco8@vodamail.co.za

Attn: Mr. Riaan Visagie

INITIAL SITE SENSITIVITY VERIFICATION : AQUATIC BIODIVERSITY ON PORTION 27 OF THE FARM ARTURSSEAT 214-KU, BUSHBUCKRIDGE LOCAL MUNICIPALITY

Refer to your request to conduct an initial verification of the current land use and the potential environmental sensitivity of the site in terms of aquatic biodiversity.

I visited the site on 13 October 2021 and conducted an on-foot survey of the site.

It was found that the site was vacant but overall heavily modified due to previous land uses and resultant severe bush encroachment by invader species. Apart from two small ephemeral drainage lines that originate on the site, no other feature that may be associated with aquatic biodiversity was identified on the site.

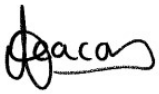
It was also found that the drainage lines contains little riparian zone properties on site and the downstream off-site condition of these drainage lines indicate severe modification due to residential settlement.

The finding of the on-site verification does not correspond with the Aquatic Biodiversity and Freshwater Ecological Priority Assessments as indicated in the Mpumalanga Biodiversity Sector Plan (2013) and this will be brought under the attention of the relevant Official of the MTPA in order to ensure future corrections.

However, based on the report that was generated by the National Environmental Screening Tool, the “low” sensitivity rating is confirmed by the on-site verification.

Based on the above it is my professional opinion that further assessment by way of a full aquatic specialist report as determined in terms of the 2020 EIA Protocols would be inappropriate and it is advised that an assessment in line with a Compliance Statement Report as set out in the 2020 EIA Protocol for Aquatic Biodiversity Assessment would be adequate for the intended purpose.

Yours sincerely



Dr. Andrew Deacon

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Abbreviations

BGIS	Biodiversity Geographic Information System
°C	Degrees Celsius
CBA	Critical Biodiversity Areas
DFFE	Department of Forestry, Fisheries and the Environment
DWA	Department of Water Affairs (post-2010)
DWAF	Department of Water Affairs and Forestry (pre-2010)
DWS	Department of Water and Sanitation (since May 2014*)*
E	East
EAP	Environmental Assessment Practitioner
e.g.	For example
EC	Ecological Category
EFR	Environmental Flow Requirements
EIA	Environmental Impact Assessment
EISC	Ecological Importance and Sensitivity Class
EIS	Ecological Importance and Sensitivity
EMP	Environmental Management Plan
EMPr	Environmental Management Programme
ESA	Ecological Support Area
EWR	Environmental Water Requirements
FEPA	Freshwater Ecosystem Priority Areas
GIS	Geographic Information System
GPS	Global Positioning System
ha	Hectares
K-factor	Soil erodibility factor/ Inherent erosion factor
km	Kilometre
KML	Keyhole Markup Language
KMZ	Keyhole Markup language Zipped
LUDS	Land-Use Decision Support Tool
m	Meter
m^2	Square meter
m^3	Cubic meter
MBSP	Mpumalanga Biodiversity Sector Plan
mm	Millimetre
MTPA	Mpumalanga Tourism and Parks Agency
NEMA	National Environmental Management Act, 1998 (Act No. 107 of 1998)
NWA	National Water Act
ONA	Other Natural Areas
PES	Present Ecological State
PESEIS	Present Ecological State, Ecological Importance and Ecological Sensitivity
Pr. Sci. Nat	Natural Scientific Professionals
REC	Recommended Ecological Category
S	South
SACNASP	South African Council for Natural Scientific Professions
TOR	Terms of Reference

INTRODUCTION

1.1 Background to the project

This project concerns the planning and development of a new township on Potion 27 of the farm Arthursseat 214-KU to create a nodal point where local residents have access to a wide range of public and commercial services and facilities focused in a single area as to allow for a more compact settlement pattern and also improve connectivity and accessibility through the township to the surrounding area (Eco 8 Environmental Planners, 2021).

The proposed public services and facilities will include medical, municipal, retail and entertainment facilities as well as municipal offices, educational facilities, learning and training centres, a hotel as well as retail and business uses. A substantial area within the township will remain available for urban agriculture and future urban expansion.

The proposed services and facilities can be made accessible by incorporating a bus and taxi-stop and to provide safe access to and from the R40 road.

The proposed township will be fully serviced by linking proposed new internal engineering services to existing road systems, water and electricity networks and where necessary to provide on-site engineering services such as sanitation.

1.2 Specialist Terms of Reference

This project proposal is prepared for an Aquatic Biodiversity Compliance Report as part of the Environmental Impact Assessment (EIA) of the proposed township development. This Compliance Verification refers to the watercourse aspects of the project area for the planning-, construction- and operational phases for the proposed town development.

The Aquatic Biodiversity Compliance Report follows the EIA Protocol for minimum report content requirements for “low” environmental sensitivity as indicated by the National Screening Tool and include:

- On-site verification of the watercourse and delineation.
- Verification of the aquatic biodiversity status on the project site.
- On-site verification of the Present Ecological Status (PES) and Environmental Importance and Sensitivity (EIS) of the watercourses.
- Watercourse buffer determination to ensure that adequate allowance is made in the township layout for conservation of the aquatic biodiversity and ecological functions.
- Determine what risks the proposed development hold for water quality and associated aquatic ecology.
- Refer to the proposed Site Development Plan with storm water mitigation proposal: assess the impact on the proposed township the proposed storm water impact mitigation measures.
- Provide additional on-site and off-site mitigation alternatives and / or mitigation measures that need to be included in the planning, construction and operational phases of the project.

AQUATIC SPECIALIST INFORMATION

2.1 AQUATIC SPECIALIST DECLARATION OF INDEPENDENCE AND COMPLIANCE

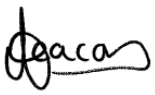
I, ANDREW DEACON as the appointed specialist hereby declare/affirm the correctness of the information provided as part of the application, and that I:

- in terms of the general requirement to be independent (tick which is applicable):

  other than fair remuneration for work performed/to be performed in terms of this application, have no business, financial, personal or other interest in the activity or application and that there are no circumstances that may compromise my objectivity; or

  am not independent, but another EAP that is independent and meets the general requirements set out in Regulation 13 has been appointed to review my work (Note: a declaration by the review specialist must be submitted);

- have expertise in conducting specialist work as required, including knowledge of the Act, regulations and any guidelines that have relevance to the proposed activity;
- will ensure compliance with the EIA Regulations 2014;
- will perform the work relating to the application in an objective manner, even if this results in views and findings that are not favourable to the application;
- will take into account, to the extent possible, the matters listed in regulation **18** of the regulations when preparing the application and any report, plan or document relating to the application;
- will disclose to the proponent or applicant, registered interested and affected parties and the competent authority all material information in my possession that reasonably has or may have the potential of influencing any decision to be taken with respect to the application by the competent authority or the objectivity of any report, plan or document to be prepared by myself for submission to the competent authority (unless access to that information is protected by law, in which case I will indicate that such protected information exists and is only provided to the competent authority);
- declare that all the particulars furnished by me in this form are true and correct;
- am aware that it is an offence in terms of Regulation 48 to provide incorrect or misleading information and that a person convicted of such an offence is liable to the penalties as contemplated in section 49B(2) of the National Environmental Management Act, 1998 (Act 107 of 1998).



Dr. Andrew deacon Date 20/12/2021

Name of firm/company : Dr. Andrew deacon Environmental Consultant

2.2 CONCISE CURRICULUM VITAE OF AQUATIC SPECIALIST

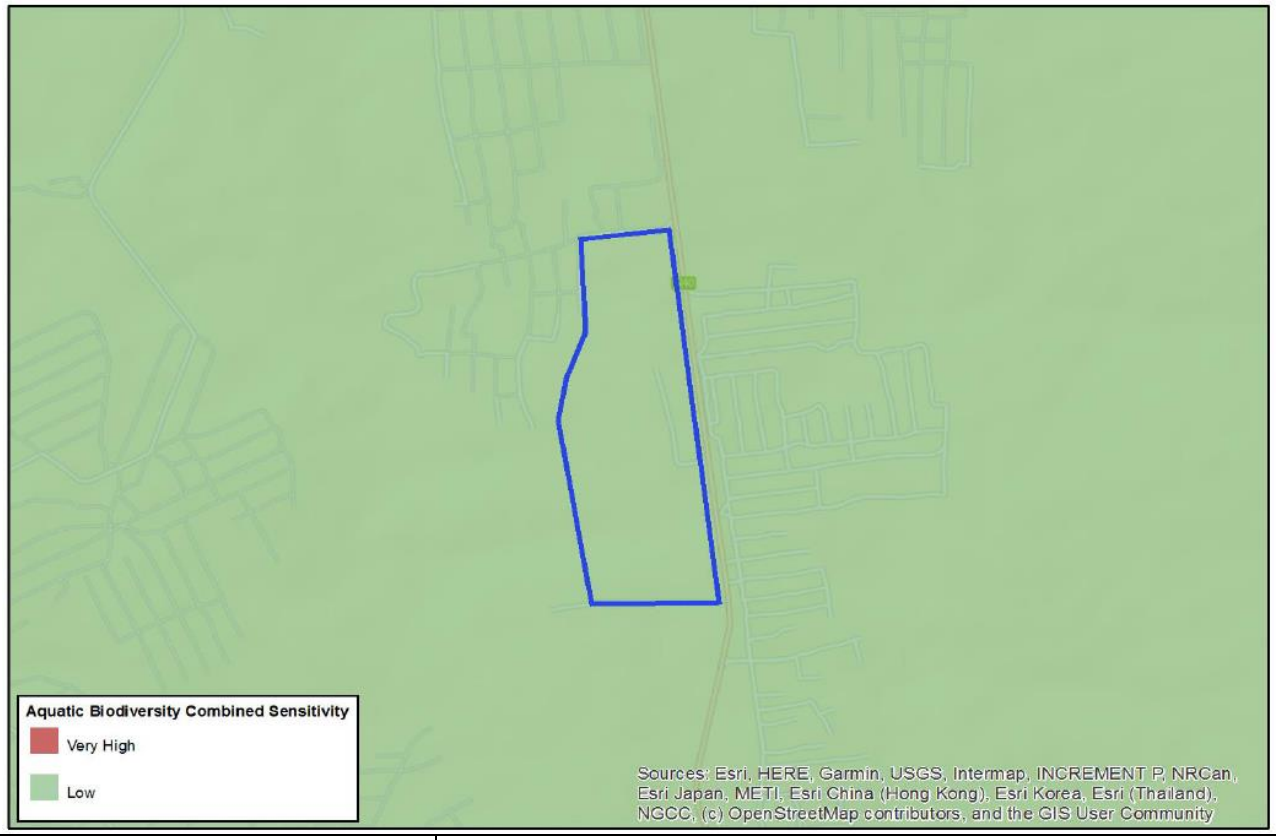
Personal information	Name: Dr Andrew Deacon Nationality: South African Identification number: 5108105091082
Practice/Firm information	Name of Practice/Firm: Dr Andrew Deacon Environmental Consultant Address: House 4, Jakkalsbessie, Opdraende Road, Malalane, 1320. Contact Number: 082 325 5583
Relevant Tertiary Education & Courses	Ph.D., Zoology (RAU 1987) Thesis: "The nutritional ecology and physiology of *Tilapia rendalli* and *Oreochromis mossambicus* in a warm, sewage-enriched habitat". M.Sc., Zoology (RAU 1983) Thesis: "The occurrence and feeding habits of *Anguilla*-species in selected rivers of the Transkei". B.Sc., Hons. - Zoology (RAU 1980) B.Sc., majors Zoology and Botany (PU for CHE 1974)
Professional Affiliation/s	Professional Natural Scientist, SA Council for Natural Scientific Professions.
Employment Record	1989-2011 Programme Manager: Scientific Services, Kruger National Park, SANParks 1984-1986 Lecturer - Department of Zoology at RAU. Biology and Taxonomy. 1983 Lecturer - Goudstad College of Education. Zoology.
Experience	Ecoleges Environmental Consultants: An ecological assessment regarding the Environmental and Water Use Authorisation for remedial work required on the SAPPI Ngodwana Dam (Mpumalanga) (2020). IWULA Integrated Water Use License Application Management (Pty) Ltd: GN509 Risk Assessment for the abstraction of water from a watercourse on the Krokodilspruit Farm (2020). Rhengu Environmental Services: Sabie Hydro Power Project in the Sabie River - Specialist ecological study for the Environmental Impact Assessment (2016-2017). Rivers for Africa: Determination of Ecological Water Requirements for surface water (river, estuaries and wetlands) and groundwater in the Lower Orange WMA (2017). Henwood Environmental Solutions: Specialist Study - A terrestrial impact assessment and riparian delineation for an agricultural application on the Farm Heidelberg (2021).
Specialisation	Aquatic Ecologist and Biodiversity Specialist.
Relevance of experience and to the specific project	Freshwater Ecology; Riparian delineation; Riparian buffer assessment; DWS Risk Assessment; PES/EIS studies.

AQUATIC SITE SENSITIVITY VERIFICATION

3.1 REQUIREMENTS FOR VERIFICATION REPORT

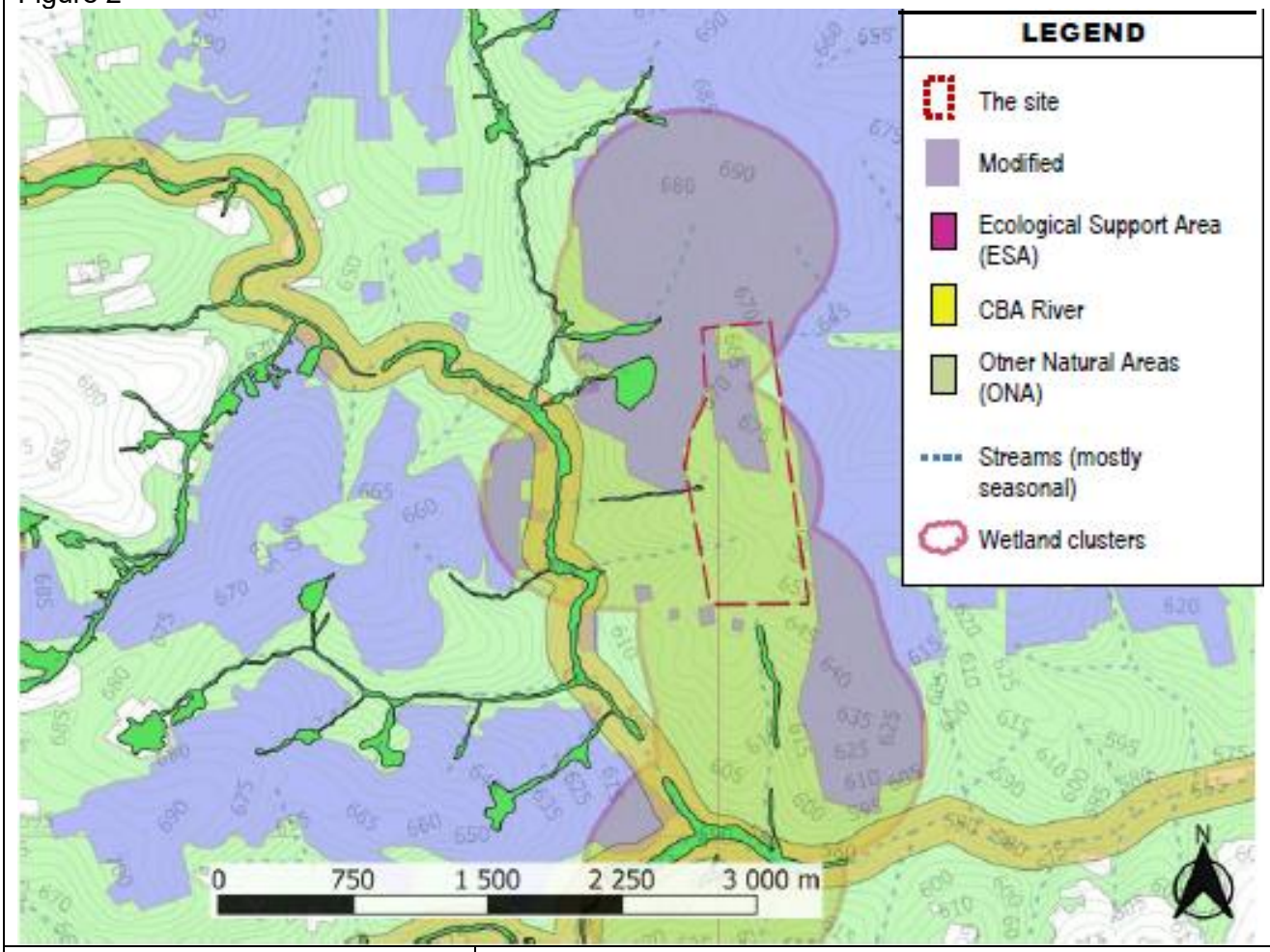
Prior to initiating an environmental impact assessment the current land use and the potential environmental sensitivity of the site as identified by the national web based environmental screening tool must be confirmed by undertaking an Initial Site Sensitivity Verification. GNR302 of 20 March 2020 sets out the requirements for site sensitivity verification and minimum report content.

3.2 DESKTOP AQUATIC BIODIVERSITY SENSITIVITY VERIFICATION

3.2.1 SCREENING OF AQUATIC SITE SENSITIVITY (NATIONAL WEB BASED TOOL)	
Figure 1 	
SCORE OF AQUATIC SENSITIVITY SCREENING	The development site is located within an area that pose a “Low” level of aquatic biodiversity.
INTERPRETATION OF THE AQUATIC SENSITIVITY SCREENING SCORE	
The Acorn City project area has been identified on the screening tool as being of “Low sensitivity” for aquatic biodiversity, therefore an Aquatic Biodiversity Compliance Statement is applicable.	

3.2.2	AQUATIC BIODIVERSITY PRIORITY ASSESSMENT (MPUMALANGA BIODIVERSITY SECTOR PLAN 2013)

Figure 2



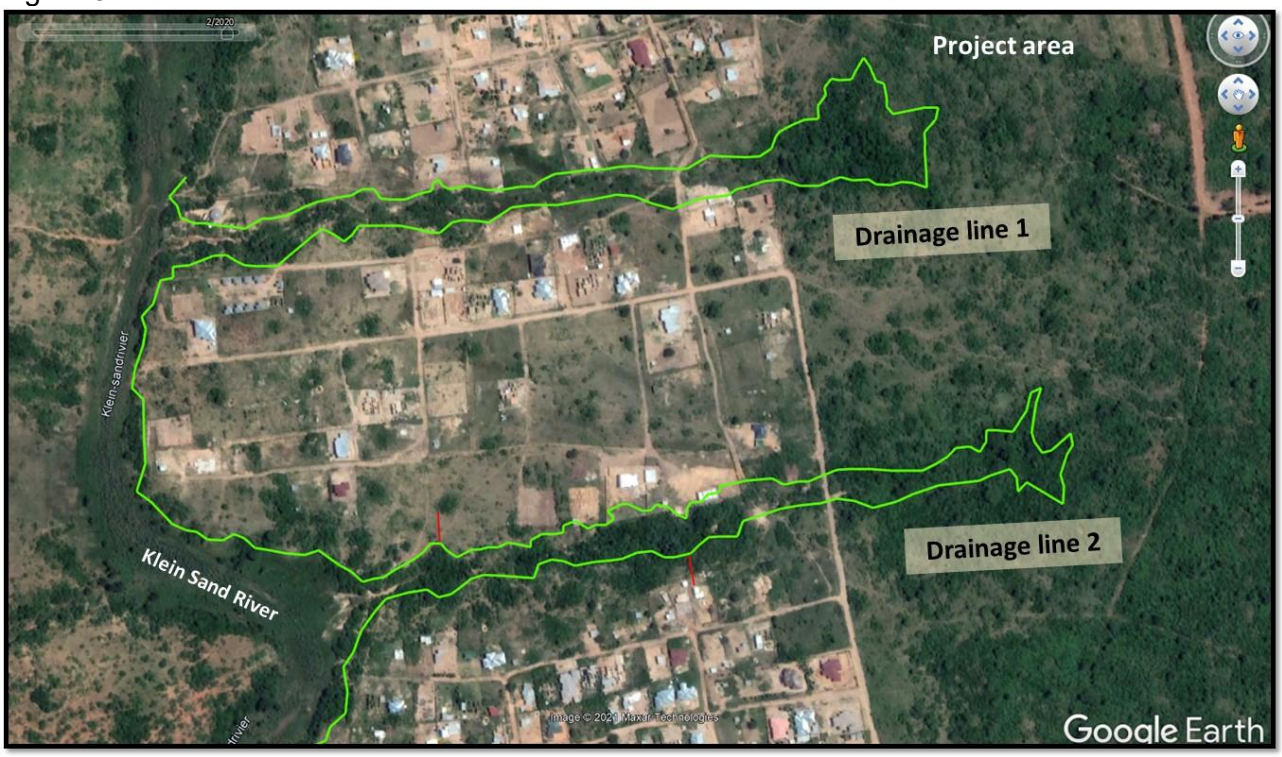
CLASSIFICATION OF AQUATIC BIODIVERSITY ASSESSMENT	The development site is located within a :modified" area and in "other natural areas" that both pose a "Low" level of aquatic biodiversity.
FRESHWATER ECOLOGICAL PRIORITY ASSESSMENT	A CBA river is located ±500m west of the site and CBA wetlands are located near to the site with one hillslope wetland that originates on the site. Accordingly the site is located within a wetland cluster buffer which is an ecological support area for the indicated wetlands.

INTERPRETATION OF THE ABOVE CLASSIFICATIONS

- Heavily Modified: which includes areas currently transformed where biodiversity and ecological function has been lost to the point that it is not worth considering for conservation at all.
- Important FEPA wetlands that have met a threshold for biodiversity targets and/or condition; the ecological status of these wetlands need to be maintained or improved, and their loss must be avoided.
- Clusters of wetlands are embedded within a largely natural landscape allow for the migration of fauna and flora between wetlands.
- The site is located within an Upstream Management Area which is a sub-quaternary catchment where human activities need to be managed to prevent degradation of downstream river FEPAs and Fish Support Areas.

3.2.3 AERIAL PHOTO / SATELLITE IMAGERY INTERPRETATION OF THE SITE

Figure 3



DESCRIPTION OF AERIAL PHOTO ANALYSIS

The Acorn City project area is situated on an open field which is the preferred site for the Project.

The site consists of an open area of degraded savanna bushveld with many footpaths criss-crossing the area. Most of the area is overgrazed by community cattle and there are some patches of overgrown and modified woodland indicating ephemeral drainage lines that drains the area towards the Klein Sand River.

The property is vacant and has historically been used for informal agriculture following its zoning. Exponential population growth over the past 10 years has changed the rural land use of the property and surrounding area.

Medium- to the high-density residential settlement now surrounds the property. The previous rural agricultural character of the area has been lost and aerial photo analysis confirms that no agricultural activity occurred on the property over past years.

The only aquatic habitats are two drainage areas draining the project area (Figure 3). These drainage lines are either seasonal or ephemeral and originate in areas of diffused drainage that are only wet and release water during periods of high rainfall. The two drainage lines are similar to each other and is discussed as one habitat type furtheron in this report.

3.2.4 LAND COVER COMPARISON 2009 - 2021

Figure 4

Figure 5

These photos illustrate the substantial change and vast spread of homestead development from 2003 to recent situation (2021) as viewed on the Google Earth time sequence.

3.3 ON-SITE AQUATIC BIODIVERSITY SENSITIVITY VERIFICATION

The Site Sensitivity Verification was undertaken by Dr Andrew Deacon and Eco8 Environmental Planners during October 2021.

Only the sources of the drainage lines are situated in the project area, the rest of the drainage runs through a densely populated and completely built-up area (Figure 5). These upstream drainage sources originate in areas of dense bush encroachment in their small catchments. These terrestrial woody areas consist of trees and shrubs that shows indications of heavy modification in terms of species composition, structure and diversity. Only a few species of which some are listed as true riparian vegetation occur right along the edge of the drainage lines.

Once the drainage lines leave the area earmarked for the Acorn City development, it deteriorates and most of the natural habitat is degraded by homestead development and other anthropological impacts (Figures 4a, 4f and 4g). Bush clearing, erosion, rubbish dumping and sand mining are some of these impacts that deteriorates the drainage lines considerably (Figures 4d - 4e).

Figures 4f & 4g illustrate the conditions of the drainage lines from the development site, downstream to wards their discharge into the Kleinsand River.

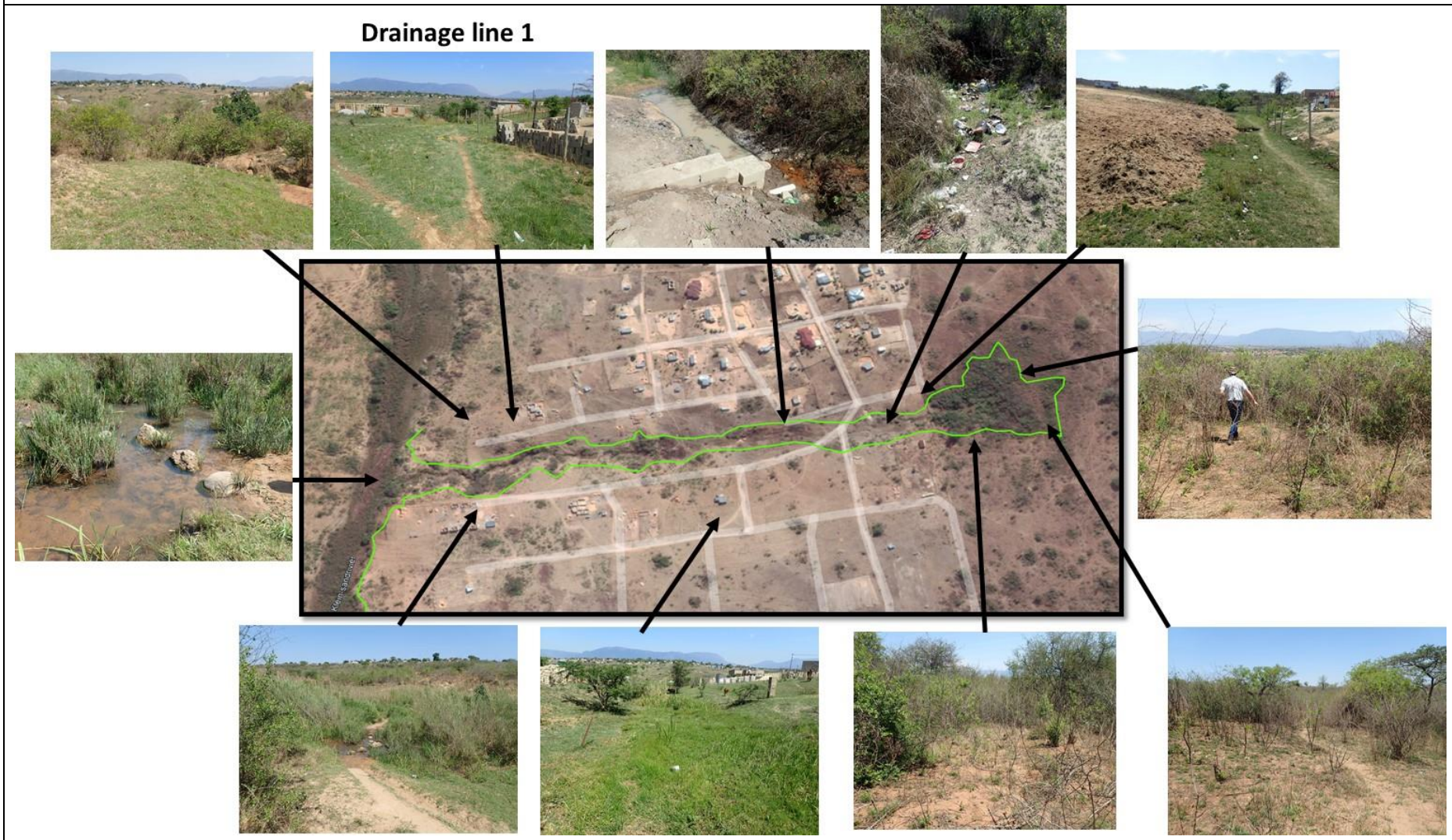
SITE PHOTO REFERENCE NUMBER: 4a

The area downstream of the project area has been transformed in many ways. This photo shows vegetation clearing as well as infilling of a building site right to the edge of the drainage line.

SITE PHOTO REFERENCE NUMBER: 4b	SITE PHOTO REFERENCE NUMBER: 4c
	

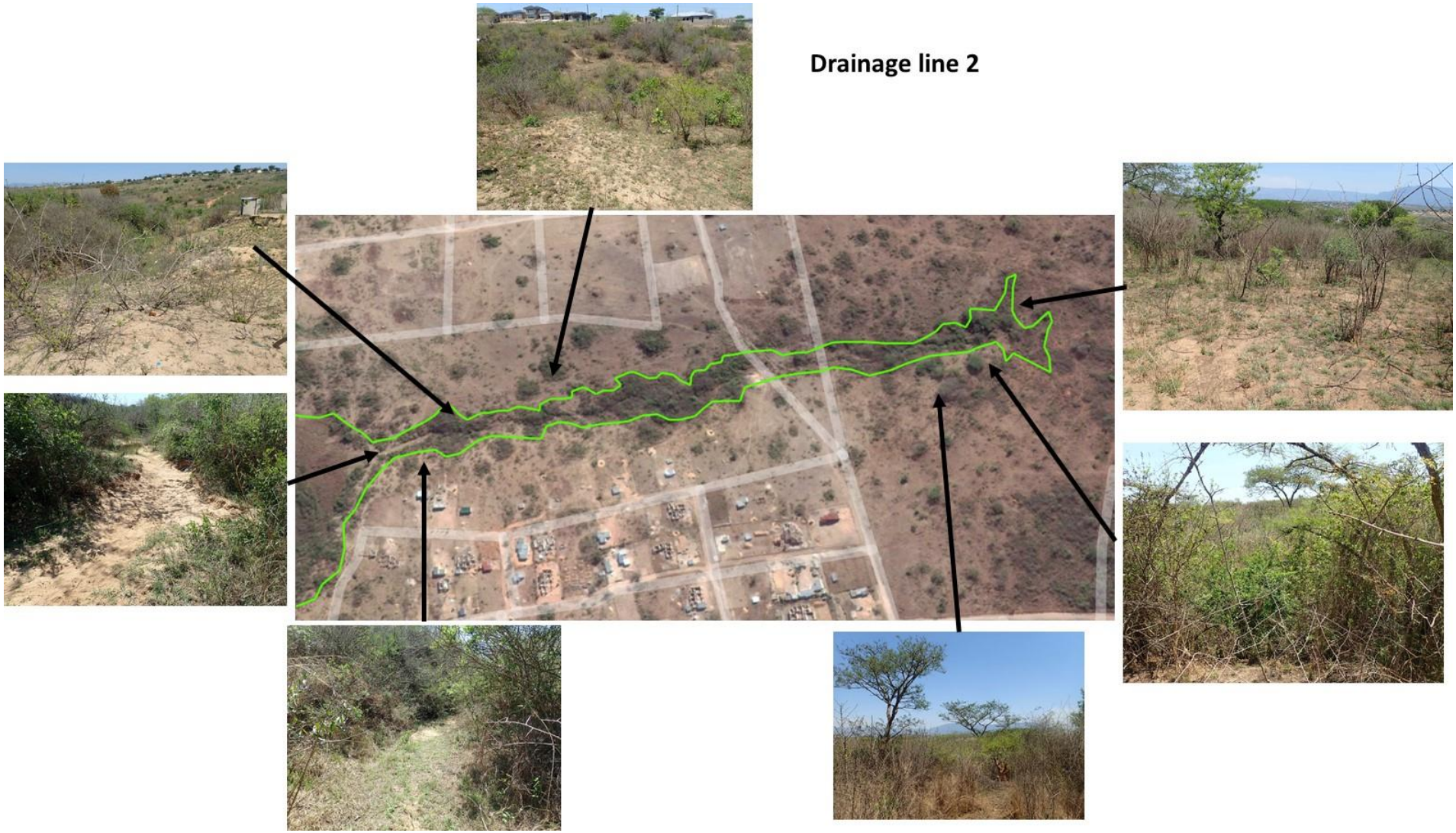
SITE PHOTO REFERENCE NUMBER: 4d	SITE PHOTO REFERENCE NUMBER: 4e
	

SITE PHOTO REFERENCE NUMBER: 4f



Drainage Line 1 is the most northern drainage and from its origin in a wood clump, it flows out of the project area into a donga denuded by development and infringing homesteads.

SITE PHOTO REFERENCE NUMBER: 4g



Drainage Line 2 is the southern most drainage, and similar to Drainage Line 1, it originate in a wood clump, it flows out of the project area into a donga denuded by development and infringing homesteads.

3.4 SITE SENSITIVITY VERIFICATION OUTCOME

3.4.1 VERIFICATION CONFIRMATION/DISPUTE

A Site Sensitivity Verification was undertaken, which involved a desktop analysis and site inspection, to verify the land use and environmental sensitivity (rating) designated by the Screening Tool. They motivated for a “Low” sensitivity at both the drainage lines and support the need for an Aquatic Biodiversity Compliance Statement.

3.4.2 VERIFICATION MOTIVATION

The site was visited on 13 October 2021 during which an on-foot survey of the site was conducted.

It was found that the site was vacant but overall heavily modified due to previous land uses and resultant severe bush encroachment by invader species. Apart from two small ephemeral drainage lines that originate on the site, no other feature that may be associated with aquatic biodiversity was identified on the site.

It was also found that the drainage lines contains little riparian zone properties on site and the downstream off-site condition of these drainage lines indicate severe modification due to residential settlement.

The finding of the on-site verification does not correspond with the Aquatic Biodiversity and Freshwater Ecological Priority Assessments as indicated in the Mpumalanga Biodiversity Sector Plan (2013) and this will be brought under the attention of the relevant Official of the MTPA in order to ensure future corrections.

However, based on the report that was generated by the National Environmental Screening Tool, the “low” sensitivity rating is confirmed by the on-site verification.

Based on the above it is my professional opinion that further assessment by way of a full aquatic specialist report as determined in terms of the 2020 EIA Protocols would be inappropriate and it is advised that an assessment in line with a Compliance Statement Report as set out in the 2020 EIA Protocol for Aquatic Biodiversity Assessment would be adequate for the intended purpose.

3.4.3 VERIFICATION RECOMMENDATION

An applicant intending to undertake an activity identified in the scope of this protocol on a site identified on the screening tool as being of “Low sensitivity” for aquatic biodiversity. The low sensitivity has been verified and confirmed during a site visit. An Aquatic Biodiversity Compliance Statement must be submitted as part of the EIA.

AQUATIC BIODIVERSITY COMPLIANCE ASSESSMENT

4.1 COMPLIANCE STATEMENT REQUIREMENTS

An applicant, intending to undertake an activity identified in the Scope of this Protocol, on a site identified as being of "low sensitivity" for aquatic biodiversity on the national web based environmental screening tool must submit an **Aquatic Biodiversity Compliance Statement** to the competent authority.

4.2 VERIFICATION CONFIRMATION

4.2.1	Initial site sensitivity screening rating.	"Low"
4.2.2	Initial site verification outcome.	"Low"
4.2.3	Date and season of the site investigation and the relevance of the season to the outcome of the assessment.	The project area was visited during the rainy season of 13 October 2021. During the one-day survey, the drainage lies were identified, delineated and surveyed for riparian and aquatic biodiversity. Although it was surveyed in the wet summer month, there only a trickle of water seeping into the Klein-sand River at the confluence. It was realised that the drainage lines will only flow for short periods during high rainfall events.

4.3 BASELINE AQUATIC BIODIVERSITY AND ECOSYSTEM DESCRIPTION

Baseline profile description of biodiversity and ecosystems of the site.

4.3.1	Aquatic ecosystem types.	Upper-midslope ephemeral watercourses as delineated (See Annexure A)
4.3.2	The threat status of the ecosystem and species as identified by the screening tool.	Low as confirmed in Section 2 of this Report.
4.3.3	An indication of the national and provincial priority status of the aquatic ecosystem, and criteria.	Moderate to high aquatic biodiversity priority status as indicated in Section 2 and in Annexure B of this report.
4.3.4	On-site verification of the presence of aquatic species, habitat, distribution and movement patterns and composition of aquatic species & communities.	Very Low presence of aquatic plant flora and no indication of aquatic fauna as indicated in Section 2 and Annexure 1 and 3 of this report.
4.3.5	The historic ecological condition (reference) as well as present ecological state the watercourse.	The current condition of both watercourses on the site and off-site are "Seriously Modified" due to historic cultivation uses and subsequent invader species encroachment and densification on site and human settlement off-site.
4.3.6	Presence of wetlands on-site and off-site.	Wetlands do not occur on-site but a hill-side seepline wetland occurs ±200m west of the site, however not directly linked to the on-site watercourses.

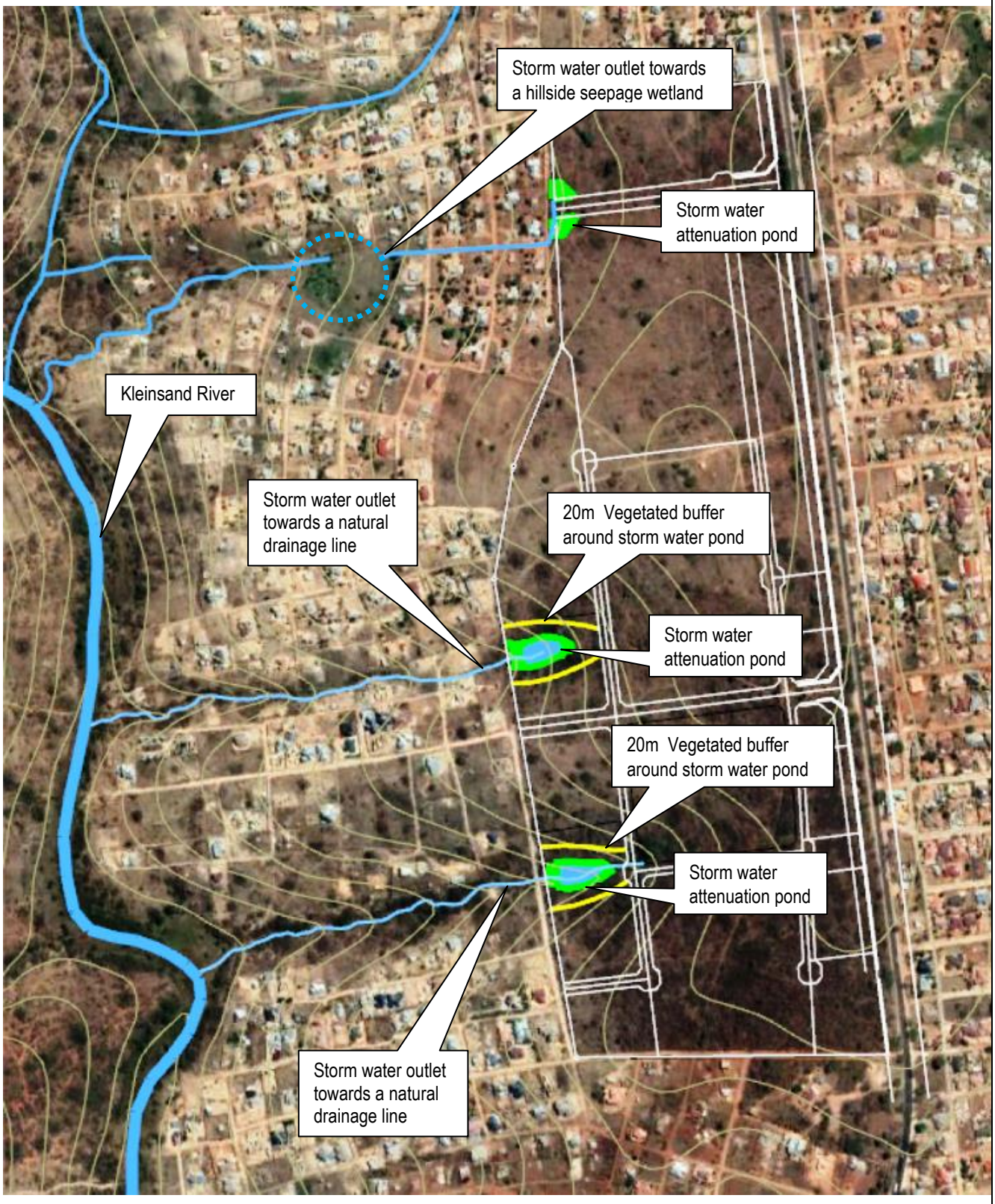
4.4 ASSESSMENT METHODS

Methodology used to assess the identified sensitivities of the aquatic biodiversity features on the site including the equipment and modelling used (where relevant) in preparation of the Compliance Statement.

4.4.1	Method of watercourse & riparian habitat identification and delineation.	*"A practical field procedure for identification and delineation of wetlands and riparian areas"* as amended and published by the Department of Water Affairs and Forestry (2005); (Henceforth referred to as DWAF Guidelines (2005). In addition to the DWAF Guidelines (2005) and DWAF updated manual (2008), the unpublished notes: *Draft riparian delineation methods prepared for the Department of Water Affairs and Forestry, Version 1* (Mackenzie & Rountree, 2007) were used for classifying riparian zones encountered on the property according to the occurrence of nominated riparian vegetation species. On-site verification of the Present Ecological State of the watercourses on site by applying the methodology obtained from the document: A Desktop Assessment of the Present Ecological State, Ecological Importance and Ecological Sensitivity per Sub Quaternary Reaches for Secondary Catchments in South Africa. (Department of Water and Sanitation 2014). On-site verification of the Environmental Importance and Sensitivity of the watercourse on site by applying the methodology obtained from the document by Kleynhans et al (Department of Water Affairs and Forestry. 1999. Assessment of Ecological Importance and Sensitivity.).
4.4.2	Other Impact assessment methods.	Land-Use Decision Support Tool (LUDS): Verification of the key results of the LUDS Report as extracted for the Acorn City Project Area from national datasets available from BGIS. Map Overlay Method: Comparison of the aquatic biodiversity assessment and the freshwater ecological priority assessment as indicated in the 2014. Mpumalanga Biodiversity Sector Plan Handbook (MTPA).
4.4.3	Method to determine the appropriate buffer.	Macfarlane, D.M., Bredin IP., Adams, JB., Zungu, MM., Bate, GC. and Dickens, CWS. 2015. Preliminary guideline for the determination of Buffer Zones for rivers, wetlands and estuaries. Consolidated Report. To the Water Research Commission by the Institute of Natural Resources. Macfarlane, D.M. and Bredin IP. 2017. Buffer Zone Guidelines for Rivers, Wetlands and Estuaries. Part 1: Technical Manual. WRC Report No. TT 715-1-17. Macfarlane, D.M. and Bredin IP. 2017. Buffer Zone Guidelines for Rivers, Wetlands and Part 2: Practical Guide. WRC Report No. TT 715-2-17.
4.4.4	Method of determining the risk	Department of Water and Sanitation (DWS). 2016. Section 21 (c) and (I) water use Risk Assessment Protocol and as contained in Appendix A in GN509 of 26 August 2016. Staatskoerant 26 Augustus 2016. No. 40229, 105.

4.5 ASSESSMENT AREA, ACTIVITIES AND MITIGATION MEASURES

SITE DEVELOPMENT PLAN WITH OVERLAY OF MITIGATION MEASURES AERIAL PHOTO / MAP OF SELECTED DEVELOPMENT SITE / FOOTPRINT AREA THAT INDICATES THE DELINEATED WATER COURSES, POTENTIAL IMPACTS AND SUITABLE BUFFERS AND MITIGATION MEASURES



4.6 IMPACT IDENTIFICATION AND MANAGEMENT OUTCOMES

		IDENTIFIED IMPACTS	PROPOSED MITIGATION
4.6.1	Direct Impacts	The conveyance of storm water from the road surfaces will be via a combination of surface channels and a sub-surface storm water pipe network. The discharge of storm water will be directed towards three small tributaries of the Klein-Sand River located ±400m west of the proposed township site. Hardening of surfaces within the township will increase concentrated storm water runoff volume and velocity which poses a flooding risk to lower-lying dwellings and down-stream erosion risk of an important downstream CBA watercourse. Construction of roads across, as well as construction of storm water attenuation ponds within these two drainage lines will require excavation and infilling which will alter the beds, banks and flow or water in these drainage lines. Unstable and poorly compacted and protected cut-and fills may lead to land sliding, soil erosion and subsequent silting and poor water quality downstream. The removal of vegetation along these drainage lines for the above purposes would not result in any significant or irreplacable loss of riparian vegetation or sensitive species, however clearing of vegetation may lead to soil erosion which may contribute to silting and poor water quality downstream.	Collection of the internal storm water runoff will be by means of catch pits, field inlets, grid inlets and kerb inlets constructed as part of the internal roadways. The discharge of storm water must be directed towards the bio-retention areas and to storm water retention ponds that must buffer the peaks, velocity and volume of storm water on site, before discharging downstream. All construction work within the watercourses must be planned taking seasonal rainfall and run-off into account and the necessary temporary run-off retention measures and erosion protection measures must be put in place during the construction period within the rainy season in order to prevent flooding and silt deposition downstream. The storm water attentaution ponds within the two watercourses must be planned to accommodate natural ecological functioning by introducing indigenous wetland and riparian vegetation along the banks, the inflow and the outflow areas of the ponds. All storm water outlets must be protected with wing walls along the sides, tapering and levelling out to prevent channeling and protected along the bed with rock pitching. Where necessary channeled surface flow along the slope must be stepped by using gabion rock matresess and stone pitching to reduce flow velocity.

4.6.2	Indirect Impacts	Run-off from the township is expected to concentrate at three main points outside the development area which can impact on downstream watercourse morphology and aquatic ecology as well as impacting on lower-lying dwellings	The peak, velocity and volume of storm water along the drainage lines from the development towards the lower-lying desidential area must not be increased. In this regard the pre-development situation should as far as possible be maintained and if necessary mitigation measures such as erosion and flood-protection measures must be incorporated at critical points along the drainage lines downstream of the development site.
4.6.3	Cumulative impacts	Cumulative deterioration of water quality by existing and potential new sources of urban storm water and wastewater pollution as well as silt deposition due to soil erosion may contribute to increased impacts on aquatic biota downstream in the Kleinsand River.	Solid waste and liquid waste that may eminate from various pollution sources on the development site during construction and operational periods must be contained, managed or treated effectively on site before such sources of pollution comes into contact with sensitive water resources downstream. A buffer area of 20m along both sides of the attenuation ponds must be maintained for the re-establishment of natural vegetation. It is well researched and accepted that a sufficient vegetated buffer area along the edge of surface water resources acts as a sink for contaminats that may ponettially transported with surface run-off towards such resources. A combination of indigenous well-rooted grass, shrubs and tree species along the outer bank areas of the stormwater ponds as well as a diverse assembly of riparian species along the inner banks of the ponds and along the inflow and outflow areas, must be established as part of the final rehabilitation of the affected sites. These measures are expected to enhance the quality of urban storm water and any treated wastewater that will be generated within the proposed township and thus prevent the cumulative water quality impacts on the Kleinsand River.

4.7 RECOMMENDATIONS

With reference to the verification results, make recommendations for impact management outcomes or any monitoring requirements for inclusion in the EMPr.
Environmental monitoring should be designed to ensure that mitigation measures are implemented. The applicant must appoint an independent ECO that will have the responsibility of monitoring and reporting on compliance with the conditions of the Environmental Authorisation (EA), as well as monitoring and reporting on the implementation of the approved EMPr. The main monitoring aspects are as follows: 1: Monitoring of vegetation clearing and soil excavations on site. Ensure that effective temporary and permanent soil stabilisation, and soil erosion prevention measures and silt containment measures are employed throughout the site during the site preparartion and construction periods. 2: Monitor the correct rehabilitation of all storm water retention and outlet structures. Ensure sufficient protection of the beds and banks of watercourses and ponds. Apply various erosion prevention techniques along all cut-and-fill slopes. 3: Re-vegetate buffer zones along water resources. A combination of indigenous well-rooted grass, shrubs and tree species along the outer bank areas of the stormwater ponds as well as a diverse assembly of riparian species along the inner banks of the ponds and along the inflow and outflow areas, must be established as part of the final rehabilitation of the affected sites. 4: Water quality requirements for the drainage lines: It is recommended that a water quality monitoring programme be implemented at the storm water retention pond where wastewater will dischared after treatment at the on-site wastewater treatment plant. The water quality should be of such a standard to comply with the minimum water quality standards as stipulated by DWS in order not to influence the Klein Sand River adversely. 5: Exotic and alien invasive plants: Monitor all sites disturbed by construction activities for colonisation by exotics or invasive plants and control these as they emerge. A seasonal alien and invasive species control program must be instituted during the operation period.

4.8 STATEMENT VALIDATION

A description of the assumptions made as well as any uncertainties or gaps in knowledge or data.
Sufficient information on the aquatic biodiversity and the freshwater ecology of the area was available to provide a baseline for the project area. Sufficient evidence was available during site verification to validate and/or to dispute the baseline information and to come to the conclusion made in this report.

4.9 CONDITIONS

Any conditions to which this statement is subjected.
Whilst the author has made every effort to verify that information provided in this report is reliable, accurate and relevant, this report is based on information that could reasonably have been sourced within the time period allocated to on-site fieldwork.

STATEMENT

4.9.1 In the case of a linear activity, confirmation from the aquatic biodiversity specialist that, in their opinion, based on the mitigation and remedial measures proposed, the land can be returned to the current state within two years of completion of the construction phase.
N/A

4.9.2 Confirm the site sensitivity for aquatic biodiversity.
The findings of this report found that the watercourses and surrounding areas pose "LOW" aquatic biodiversity. It was found that the site was vacant but overall, heavily modified due to previous land uses and resultant severe bush encroachment by invader species. Apart from two small ephemeral drainage lines that originate on the site, no other feature that may be associated with aquatic biodiversity was identified on the site. It was also found that the drainage lines contain little sensitive riparian zone properties on site and the downstream off-site condition of these drainage lines indicate severe modification due to residential settlement. Based on the report that was generated by the National Environmental Screening Tool, the "Low" sensitivity rating is confirmed by the on-site verification. However, the finding of the on-site verification does not correspond with the Aquatic Biodiversity and Freshwater Ecological Priority Assessments as indicated in the Mpumalanga Biodiversity Sector Plan (2013). This can be attributed to the following: • When the Biodiversity Areas Maps were compiled, the 2009/2010 Land Cover Assessment data were applied. During that period, the relatively low level of human settlement and associated development, resulted in the sensitivity and importance categorisation of the aquatic freshwater CBAs to be moderate to high. The relative untransformed area could be categorised as Category B (Largely natural with few modifications). • Due to extensive expansion of township over the past ten years, the untransformed area was rapidly transformed to a very low Category E (Seriously modified), where homesteads covered most of the area surrounding the project area. The project area was not impacted to the same extent as the surrounding area however historic agriculture and people movement on the site occurred which downgraded the project area from a Category B to a Category C (Moderately transformed). • Due to the added alien invading vegetation within the drainage lines of the project area, these habitats were degraded to a Category CD, however further downstream of the project area, the surrounding impacts degraded these biotopes even further to a Category D (Largely modified). • The Klein Sand River is in a Category C (Moderately transformed). Based on the actual site low site sensitivity as mentioned above it was decided that further assessment by way of a full aquatic specialist report as determined in terms of the 2020 EIA Protocols would be inappropriate.

4.9.3 Indicate whether or not the proposed development will have an impact on aquatic features on the site (after applying mitigation measures).

Judging from the impact identification and the mitigation proposed, the drainage line PES, as well as the Klein Sand River PES, will not be affected by the construction or operation of the township development subject to implementation of the proposed mitigation measures.

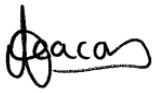
In order to protect the downstream drainage lines in their current condition from potential degradation, storm water retention ponds are required and a vegetative buffer of 20 m wide on both sides of the proposed ponds must be maintained according to the DWS buffer tool assessment.

This buffers will ensure that the zones around the storm water attenuation ponds will be incorporated within “open space” erven within the township.

Taking the “low” sensitivity and importance rating of the watercourses into account, the proposed urban infrastructure installations that are required within and over the watercourses should not pose a detrimental direct, indirect or cumulative impact on the watercourses, subject to implementation of the required mitigation measures.

By implementing all the mitigation measures and managing the system on a continuous basis as prescribed by the Risk Assessment, all the impacts can be addressed to a satisfactory level.

Therefore, it is proposed that the project should be authorised with the provision that the mitigation measures prescribed in this document, where applicable, are included in the EMPr.



Dr. A. R. Deacon 15/12/2021 Date

WATERCOURSE DELINEATION AND DESCRIPTION

1. PROJECT INFORMATION

1.1	PROJECT NAME	Acorn City Mix Use Township
1.2	PROPERTY DESCRIPTION	Portion 27 of the farm Arthursseat 214-KU

2. WATERCOURSE DELINEATION TERMS OF REFERENCE

The following terms of reference were provided by Eco-8 Environmental Planners:

Delineate the watercourses on-site and determine an appropriate buffer by applying the DWS 2014 Rivers and Wetlands Buffer Model. Provide a map of sensitive aquatic biodiversity

The method to delineate the watercourses on the project site followed the "*Practical field procedure for identification and delineation of wetlands and riparian areas"* as amended and published by the Department of Water Affairs and Forestry (2005); (Henceforth referred to as DWAF Guidelines 2005).

In addition to the DWAF Guidelines (2005) and DWAF updated manual (2008), the unpublished notes: *Draft riparian delineation methods* prepared for the Department of Water Affairs and Forestry, Version 1 (Mackenzie &Rountree, 2007) were used for classifying riparian zones encountered on the project site according to the occurrence of nominated riparian vegetation species.

Describe the watercourses in terms of 2013. Classification System for Wetlands and other Aquatic Ecosystems in South Africa. User Manual: Inland Systems. *SANBI Biodiversity Series* 22. South African National Biodiversity Institute, Pretoria.

3. APPLICABLE DEFINITIONS

A watercourse is *a) a river or spring; (b) a natural channel in which water flows regularly or intermittently; (c) a wetland, pan, lake or dam* into which, or from which, water flows; and any collection of water which the Minister may, by notice in the Gazette, declare to be a watercourse as defined in the National Water Act, 1998.

It is important to differentiate between wetlands and riparian habitats. Riparian zones are not wetlands, however, depending on the ecosystem structure, wetlands can also be classified as riparian zones if they are located in this zone (e.g. valley bottom wetlands). Although these distinct ecosystems will be interactive where they occur nearby, it is important not to confuse their hydrology and eco-functions.

Riparian areas are protected by the National Water Act (Act 36 of 1998), which defines a riparian habitat as follows:

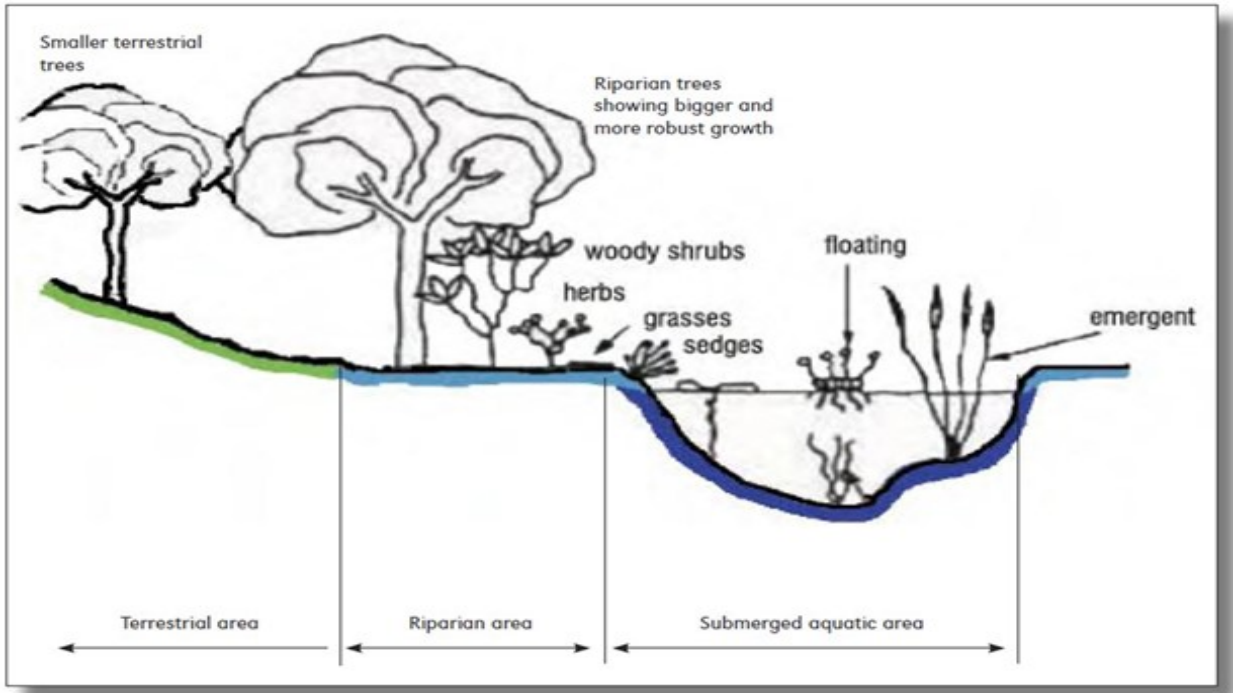
> *"Riparian habitat includes the physical structure and associated vegetation of the areas associated with a watercourse which are commonly characterised by alluvial soils, and which are inundated or flooded to an extent and with a frequency sufficient to support vegetation of species with a composition and physical structure distinct from those of adjacent land areas."*

Riparian areas include plant communities adjacent to and affected by surface and subsurface hydrologic features, such as rivers, streams, lakes, or drainage ways. Due to water availability and rich alluvial soils, riparian areas are usually very productive.

The tree growth rate is high and the vegetation is lush and includes a diverse assemblage of species. The delineation process requires that the following be taken into account:

- Topography associated with the watercourse;
- Vegetation;
- Alluvial soils and deposited material.

A typical riparian area according to the DWAF Guidelines (2005) is illustrated as follows.



4. WATERCOURSE CLASSIFICATION

Table 1. Watercourse Classification	
REGIONAL SETTING	Lowveld Ecoregion
LANDSCAPE SETTING	Slope
HYDRO-GEOMORPHIC UNIT	Upper-mid-slope well defined active channel, moderately steep longitudinal zonation, no floodplain with the marginal riparian zone.
HYDROLOGICAL REGIME	Mostly dry, non-perennial and intermittent depending on local precipitation.
SUBSTRATUM TYPE	Natural drainage lines on sandy soil.
VEGETATION COVER	Non-aquatic, mainly shrubs/thicket, low occurrence of herbaceous vegetation, moderate alien woody infestation.

5. DELINEATION METHODS AND FINDINGS

5.1 Desktop watercourse delineation: Aerial photography analysis

Aerial photographs and land surveys were used to determine the different features and riparian areas of the study area. Vegetation diversity and assemblages were determined by completing survey transects along all the different vegetation communities identified in the riparian areas. Due to the obvious and continuous changes in the local environment, obscuring the true riparian zone, it was decided to assess Google Earth images from the earliest available images. The first clear image of the project area is illustrated in Figure 1 on the left (2009). The riparian corridor is more distinct than the latest images illustrated in Figure 2 on the right (2021) due to human-related development encroaching increasingly onto the drainage environment.

The watercourses in the project area are situated at an upper mid-slope terrain setting and are presumed to be dry based on the dispersion of riparian areas mentioned above. These natural watercourses mainly act as precipitation surface run-off drainage lines, draining from east to west on the property.

Figure 1 Undeveloped project area 2009

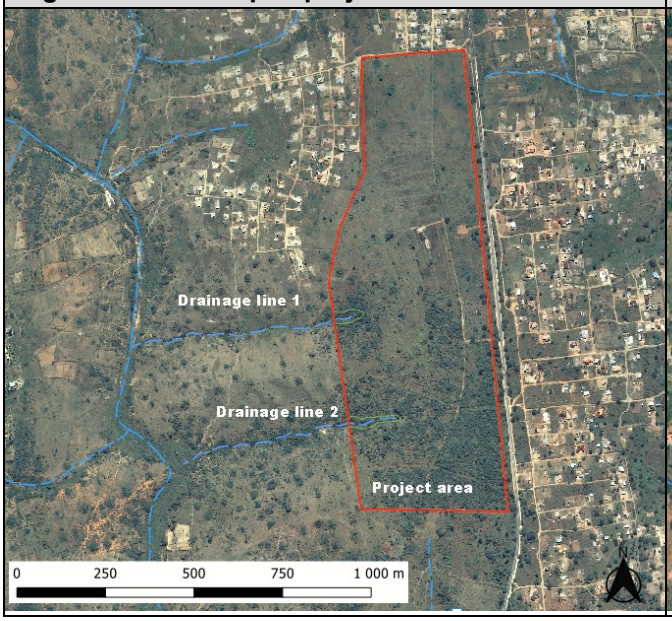
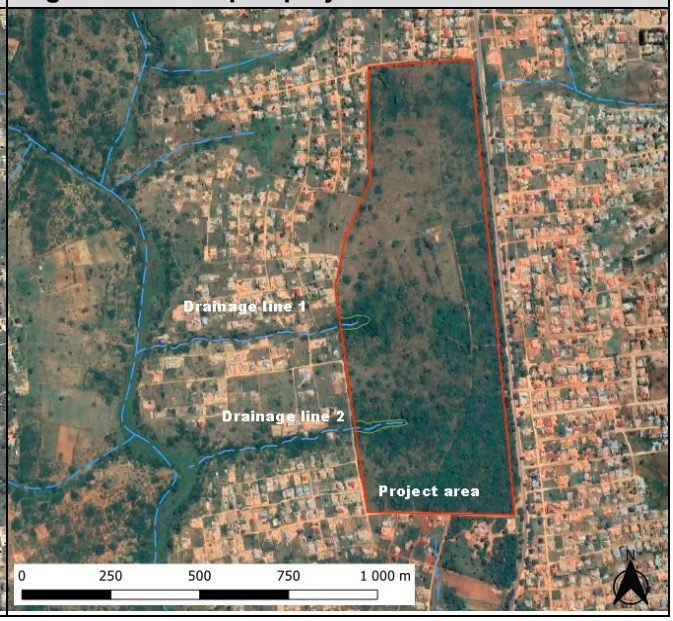


Figure 2: Developed project area 2021



A comparison of the delineated riparian zone (green lines) of the Acorn City project area drainage lines during two different periods: 2009 versus 2021.

5.2 On-site Watercourse Delineation - Transect method

A major component is the characterization of habitat types of the available landscape/environment. Representative survey sites were selected in the two drainage lines running through the study area. GPS readings provide fixed locations of these transects for future monitoring (Table 2).

During the process of riparian delineation of Drainage 1 and 2, three transects (20-30m) were surveyed per drainage line. A transect runs from the outer edge of one riparian zone (left bank), through the drainage line to the outer edge of the other riparian zone (right bank). Transects were then surveyed for all local riparian flora and aquatic habitats. The results of the surveys are illustrated in Figures 2 and 3 and the vegetation survey assemblages and relevant plant species in the identified morphological levels in the project drainage lines are summarised in Table 3. (Shaded cells indicate the presence of the species).

Table 2: Watercourse delineation				
Project area transects	Coordinates		Transect Length (m)	Drainage line width
	Start	End		
Drainage line 1				
Transect 1.1	24°38'20.40"S 31° 1'58.15"E	24°38'22.62"S 31° 1'57.84"E	55m	6-15
Transect 1.2	24°38'18.94"S 31° 2'9.64"E	24°38'21.11"S 31° 2'9.62"E	56m	5-6
Transect 1.3	24°38'16.25"S 31° 2'17.78"E	24°38'20.61"S 31° 2'17.29"E	134m	1-5
Drainage line 2				
Transect 2.1	24°38'30.59"S 31° 2'1.52"E	24°38'32.65"S 31° 2'3.00"E	75m	20
Transect 2.2	24°38'28.90"S 31° 2'13.06"E	24°38'30.81"S 31° 2'13.73"E	66m	5
Transect 2.3	24°38'26.48"S 31° 2'22.38"E	24°38'29.35"S 31° 2'23.03"E	93m	4

Table 3: Plant species	Occurrence / Position in the local landscape		
Plant species	Drainage bed	Marginal (Riparian) zone	Adjacent terrestrial habitats
Trees			
African wattle (*Peltophorum africanum*)			
Broom cluster fig (*Ficus sur*)			
Common num-num (*Carissa bispinosa*)			
Common spike thorn (*Gymnosporia buxifolia*)			
Bluebush (*Diospyros lycioides*)			
Jackal berry (*Diospyros mespiliformis*)			
Lowveld bitter tea (*Gymnanthemum colorata*)			
Magic guarri*(Euclea divinorum)*			
Marula (*Sclerocarya birrea*)			
Mobola plum (*Parinari curatellifolia)*			
Natal mahogany (*Tricheliae metica*)			
Paperbark thorn *(Vachellia sieberana*)			
River bushwillow (*Combretum erythrophyllum*)			
Sickle bush (*Dichrostachys cinerea*)			
Small-leaved willow *(Salix mucronata)*			
Silver cluster-leaf (*Terminalia sericea*)			
Sourplum*(Ximenia caffra)*			
Tassel berry (*Antides mavenosum*)			
White-berry bush (*Flueggea virosa*)			
Wild custard-apple (*Annona senegalensis*)			
Alien species			
Guava (*Psidiumguajava*)			
Christmas berry (*Lantana camara*)			
Peanut senna (*Senna didymobotrya*)			
Plant species	Drainage bed	Marginal (Riparian) zone	Adjacent terrestrial habitats
Grass and sedges			
Couch grass *(Cynodon dactylon)*			
Sedges			
Thatching reed (*Phragmites mauritianus)*			

A total of 20 indigenous plant species were recorded during fieldwork, three alien species were recorded. Four of the recorded plant species are considered riparian indicator species:

- Small-leaved willow *(Salix mucronata)*
- River bushwillow (*Combretum erythrophyllum*)
- Wild custard-apple (*Annona senegalensis*)
- Couch grass *(Cynodon dactylon)*

Figure 3: Basic drainage line components: Drainage line 1.

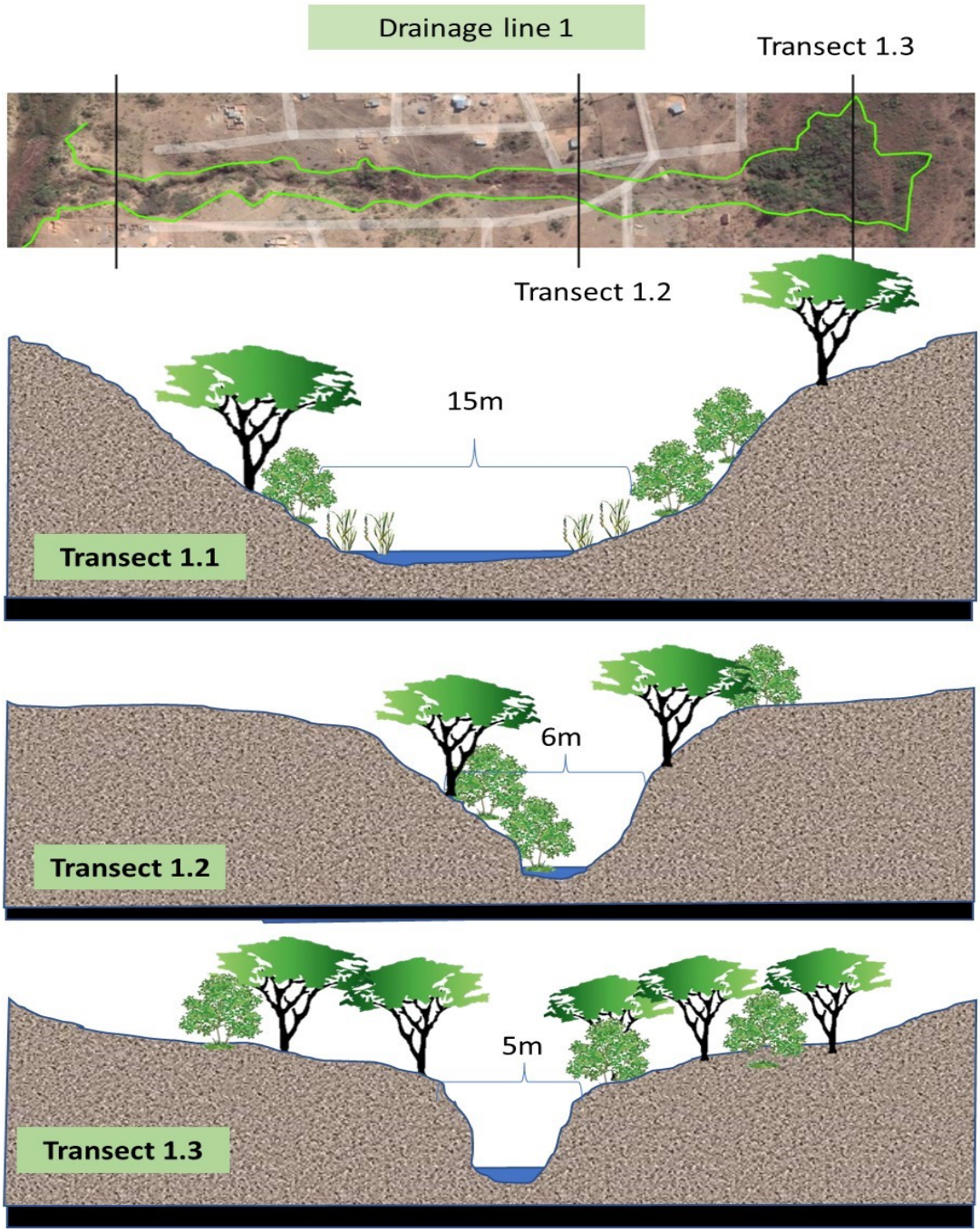
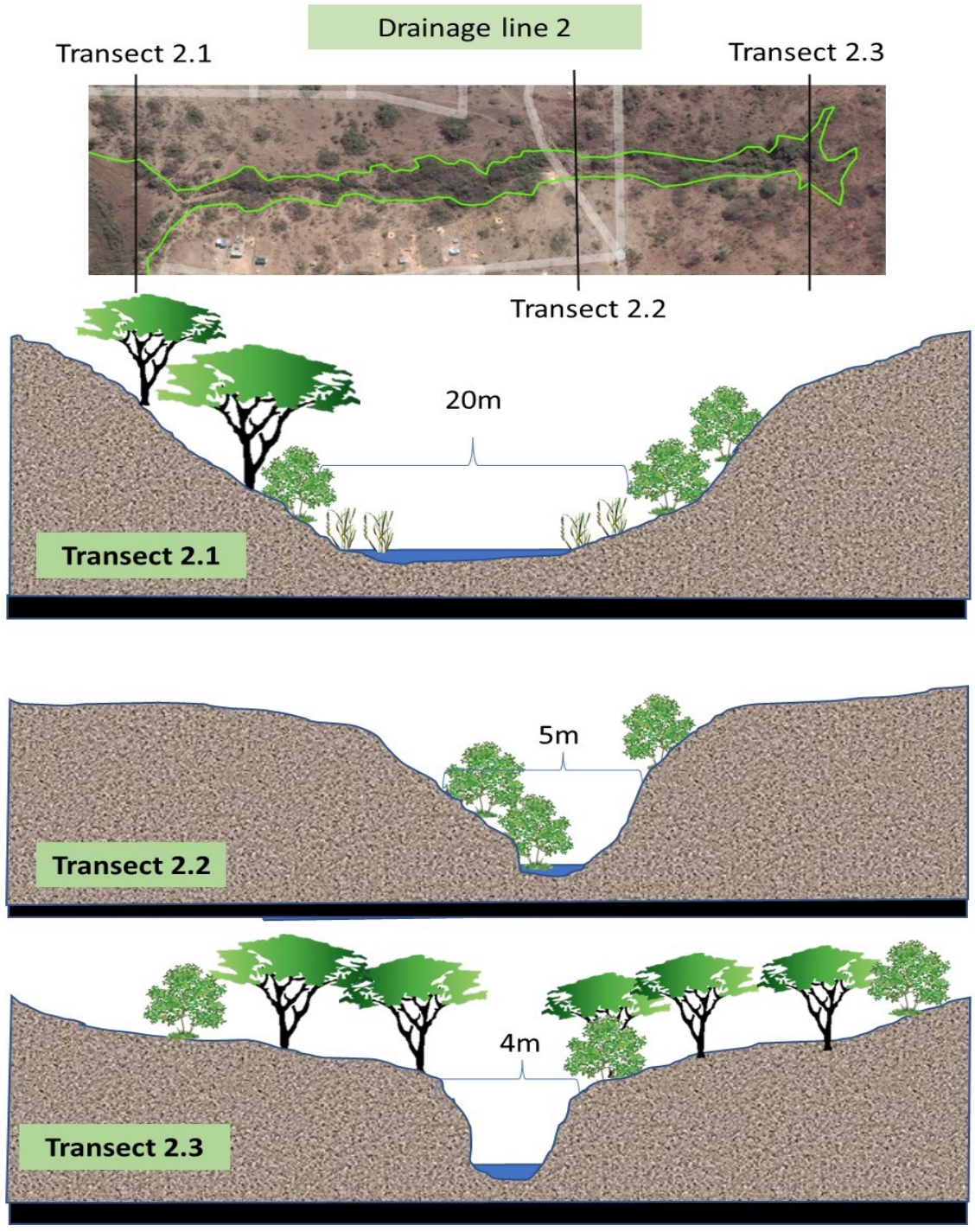


Figure 4: Basic drainage line components: Drainage line 2.



AQUATIC BIODIVERSITY VERIFICATION

1. PROJECT INFORMATION

1.1	PROJECT NAME	Acorn City Mixed Use Township
1.2	PROPERTY DESCRIPTION	Portion 27 of the farm Arthursseat 214-KU

2. AQUATIC BIODIVERSITY VERIFICATION TERMS OF REFERENCE

To establish how important the site is for meeting aquatic biodiversity targets, it is necessary to answer the following three simple but fundamentally important questions:

- How important is the site for meeting aquatic biodiversity objectives (e.g., is it in a Critical Biodiversity Areas (CBA) or Ecological Support Area (ESA)?
- Is the proposed land-use consistent with these objectives or not (to be checked against the land-use guidelines)?
- Does the sensitivity of this area trigger the requirements for assessing and mitigating environmental impacts of developments, or in terms of the listed activities in the EIA regulations?

The following terms of reference were provided by Eco-8 Environmental Planners:

- Conduct a site investigation including ground-truthing of the aquatic biodiversity and freshwater ecological value of the site in terms of the Mpumalanga Biodiversity Sector Plan.

3. AQUATIC BIODIVERSITY BASELINE INFORMATION

3.1 MBSP and LUDS

The Mpumalanga Biodiversity Sector Plan (MBSP 2014) indicates the importance of the project site for meeting pre-determined aquatic biodiversity targets. A Land-Use Decision Support Tool (LUDS) is used together with the findings of the MBSP as a guideline for biodiversity planning in support of an on-site specialist ecological assessment.

The biodiversity priority assessment maps contained in the MBSP includes areas of Critical Aquatic Biodiversity (CBAs), Aquatic Ecological Support Areas (ESAs) and Freshwater Ecological Priority Areas (FEPAs).

- *Aquatic Critical Biodiversity Areas (CBAs*) are areas that are required to meet biodiversity targets for aquatic species, aquatic ecosystems, or ecological aquatic processes.
- *Aquatic Ecological Support Areas (ESAs)* are areas that play an important role in supporting the functioning of aquatic CBAs and for delivering ecosystem services.
- *Freshwater Ecological Priority Areas* are identified as nationally important freshwater ecosystems in need of protection of which the datasets have been incorporated into the MBSP.

Overlaying the MBSP (2014) Biodiversity Priority Maps onto the Acorn City Project Area, resulted in the compilation of Figures 1 to 5 and Table 1.

Table 1: The key results of the MPCP Maps compared with on-site verification / status				
National Data Set	**Aspect**	**Description**	**MBCP Map**	**Comparable with on-site verification**
Critical Biodiversity Areas	CBA Aquatic species	Areas considered critical for meeting the habitat requirements for selected aquatic invertebrate species. These species are known to occur only at one or a few localities and are at high risk of extinction if their habitat is lost	No	N/A
	CBR Rivers	Special rivers, with a 100 m buffer, that meet a threshold for riparian sensitivity and/or condition and whose condition should not be allowed to deteriorate. This category includes FEPA rivers and NFEPA free flowing rivers	No	N/A
	CBA Wetlands	Important FEPA wetlands that have met a threshold for biodiversity targets and/or condition; the ecological status of these wetlands need to be maintained or improved, and their loss must be avoided	Yes	No, verification on-site revealed seriously modified watercourses.
Ecological Support Areas	ESA Wetlands	Although not classed as FEPAs, they support the hydrological functioning of rivers, water tables, and freshwater biodiversity, as well as providing a host of ecosystem services through the ecological infrastructure that they provide.	No	N/A
	ESA Wetland clusters	Clusters of wetlands are embedded within a largely natural landscape allow for the migration of fauna and flora between wetlands.	Yes	No, verification on-site revealed seriously modified watercourses.
	ESA Important sub-catchments	Sub-catchments that either support river FEPAs or fish support areas.	Yes	No, verification on-site revealed seriously modified watercourses.
	ESA Fish support areas	Sub-catchments that harbour fish populations of conservation concern	No	N/A
	ESA Strategic surface water source areas	High rainfall receiving areas that produce 50% of Mpumalanga's runoff in only 10% of surface area, thus supporting biodiversity and regional water security	Yes	Verified
Other Natural Areas	Not prioritised for immediate conservation.	Retain most of their natural character and perform a range of ecosystem services from their ecological infrastructure in varying efficiency and effectiveness and not directly essential for ensuring persistence in support of CBAs or ESAs.	No	N/A
Heavily Modified Areas	Human modify-cation of the land cover that does not contribute to biodiversity targets.	Heavily Modified: which includes areas currently transformed where biodiversity and ecological function has been lost to the point that it is not worth considering for conservation at all.	Yes	Verification on-site revealed a seriously modified area surrounding the watercourses.

4. AQUATIC BIODIVERSITY FINDINGS

4.1 Sensitivity of the aquatic biodiversity.

4.1.1 Aquatic ecosystem types

Both the drainage lines originate from crest and upper-midslope surface run-off on the property. These surface flows are very sporadic and short-lived and do not persist long enough to form viable instream habitats. Both the watercourses are therefore classified as ephemeral surface water drainage lines.

4.1.2 Presence of aquatic species

Due to the lack of short persistence of aquatic habitats, no aquatic species are able to settle in these drainage habitats.

4.2 Conclusion

The 2013 Mpumalanga Biodiversity Sector Plan indicated several potentially sensitive and important freshwater aquatic features on and around the project area. After a site visit, ground truthing revealed that the watercourses and surrounding area have been heavily modified due human settlement activities over the past ten years. The ecosystem services and ecological infrastructure as prescribed in the 2013 Mpumalanga Biodiversity Sector Plan's CBA and ESA are therefore outdated and not a true reflection of the actual land cover, their sensitivity and importance.

Figure 1: The Land Cover Assessment of the Acorn City Project Area as illustrated by theLUDS programme (BGIS, 2015) for Mpumalanga.2010 = historical built-up areas (grey) versus Google Earth background of the 2021 built-up expansion.

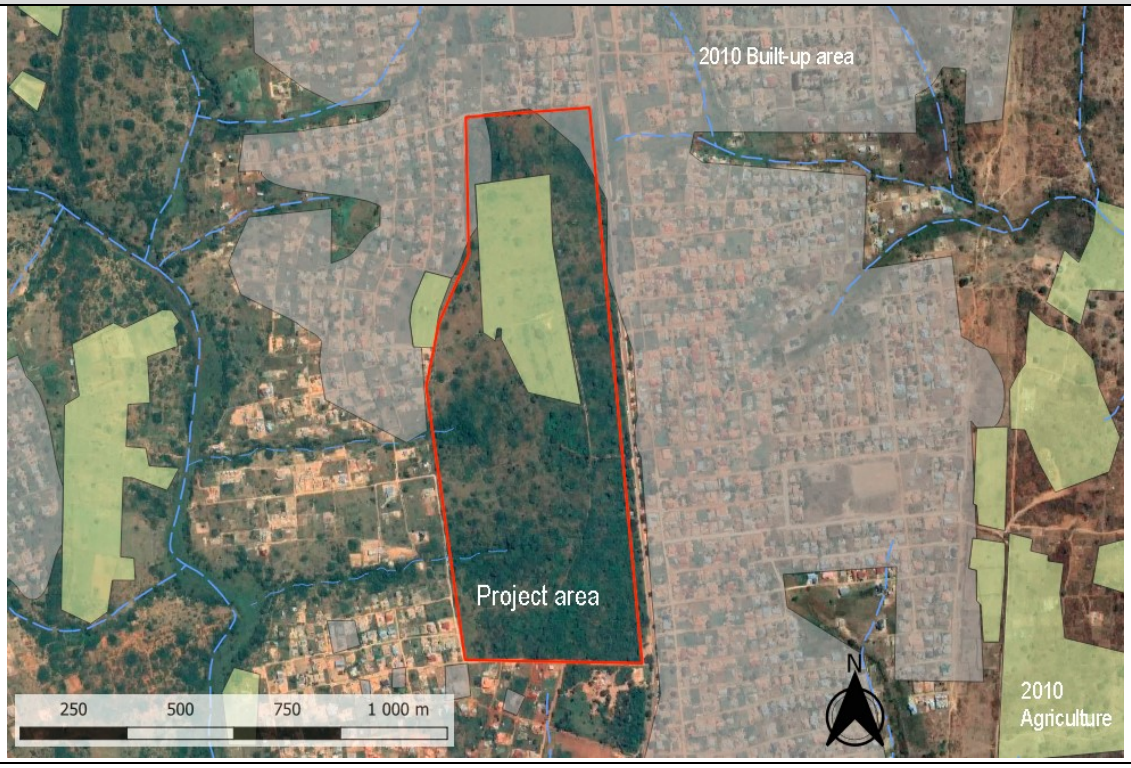


Figure 2:a) A map obtained by the 2014 Mpumalanga Biodiversity Sector Plan to indicate the Freshwater CBAs and ESAs in the project area. b) This insert illustrates the near-complete transformation of the ESA Wetland cluster to a built-up communal area.

A

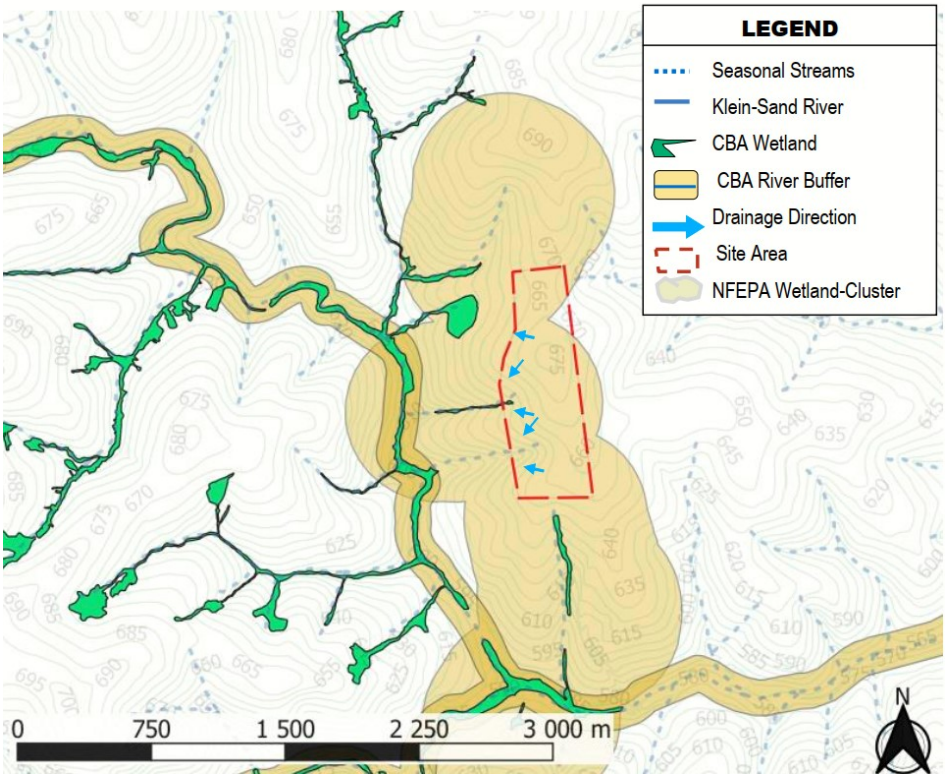


Figure 2:b) A map obtained by the 2014 Mpumalanga Biodiversity Sector Plan to indicate the Freshwater CBAs and ESAs in the project area. b) This insert illustrates the near-complete transformation of the ESA Wetland cluster to a built-up communal area.

B

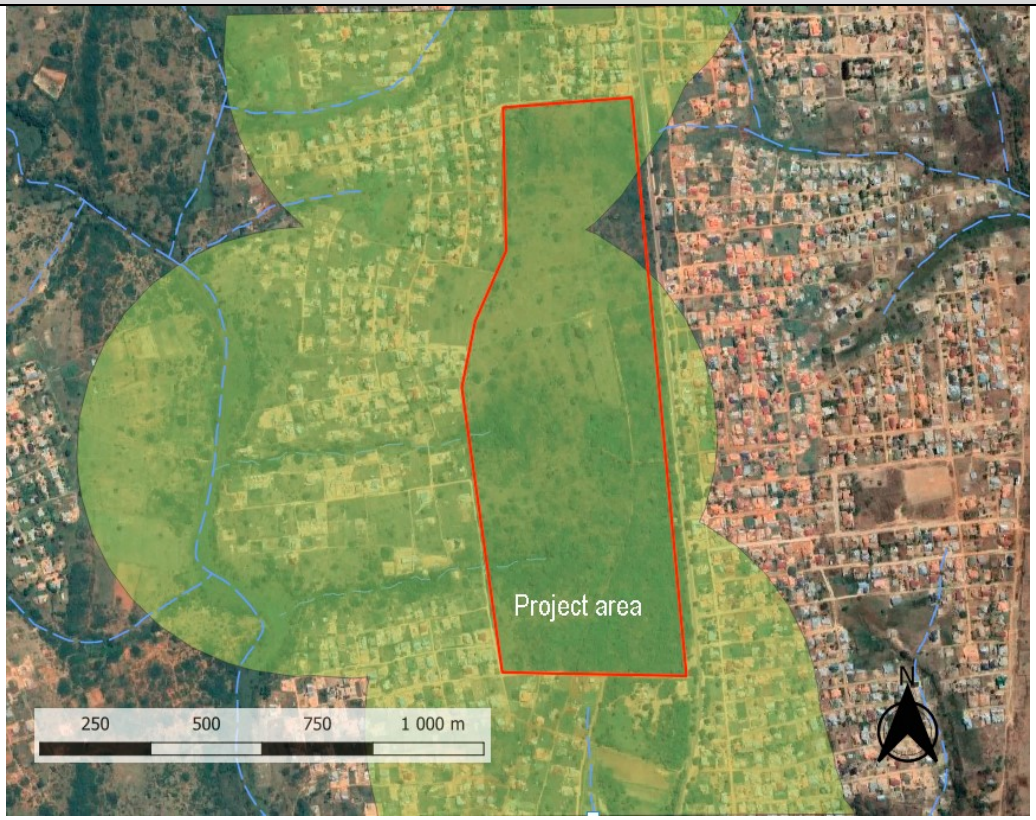
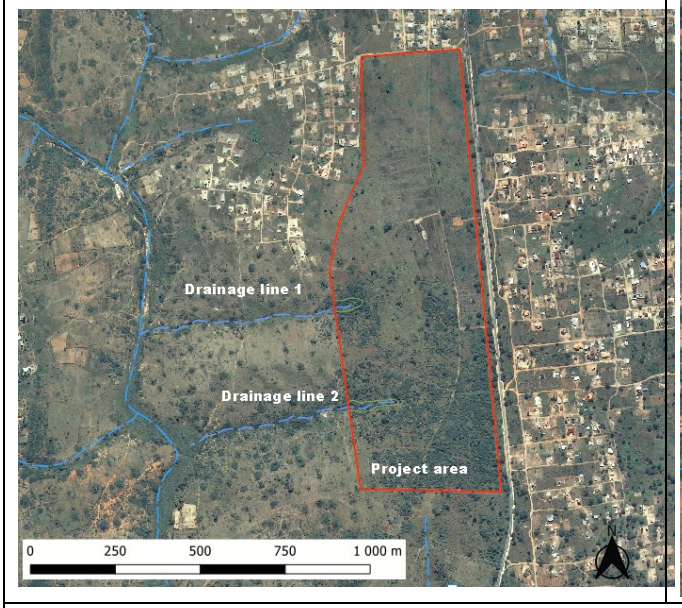
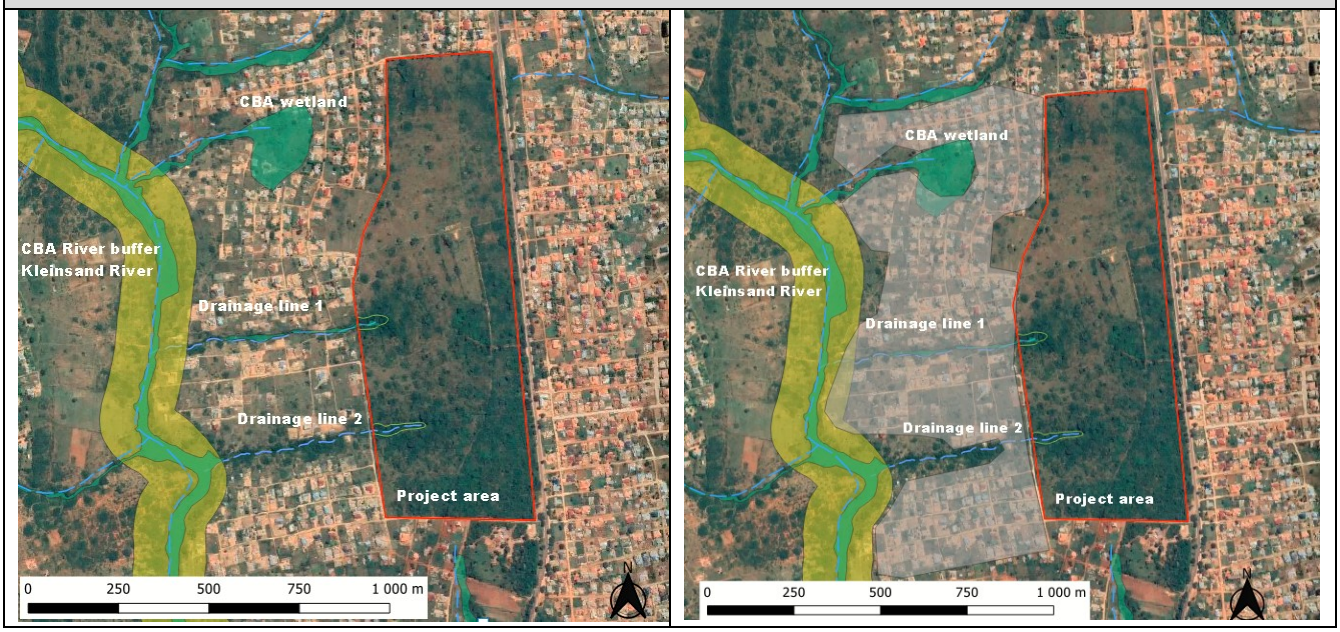


Figure 3 Undeveloped project area 2009	Figure 4: Developed project area 2021
	

This figure compares two Google Earth figures of the project area to illustrate the expansion of township development between 2009 and the current situation (2021).

Figure 5: This figure compares two figures of the project area to illustrate: (left) the Critical Biodiversity River and Wetland for the Acorn City Project Area as illustrated by the LUDS programme (BGIS, 2015) for Mpumalanga; (right) the expansion of township development between since the CBAs were established.



WATERCOURSE ECOLOGICAL STATUS CLASSIFICATION

1. PROJECT INFORMATION

1.1	PROJECT NAME	Acorn City Mix Use Township
1.2	PROPERTY DESCRIPTION	Portion 27 of the farm Arthursseat 214-KU

2. ECOLOGICAL STATUS ASSESSMENT TERMS OF REFERENCE / METHOD

Apart from establishing the extent of the riparian zones by way of the transect method and by way of the riparian vegetation survey (refer to Annexure 1), the applied method also provides information to assess the Present Ecological State (PES) of the drainage lines, and their Environmental Importance and Sensitivity (EIS) for identifying potential impacts on the two drainage lines on the project site related to the proposed development of a mix use township.

The method of determining the PES and EIS of the drainage lines that occur on the project site is based on the DWS/WRC *Manual for Eco-Status Determination (2007 Version 2). Module A: Eco-Classification and Eco-Status determination (Kleynhans & Louw).*

The PES of a watercourse is expressed in terms of various components i.e. drivers (Physico-chemical, geomorphology, hydrology) and biological responses (presence of fish, riparian vegetation and aquatic invertebrates) as well as an integrated state, which is referred to as the Ecological Status or Eco-Status of a watercourse.

The Eco-Status can be defined as *the totality of the features and characteristics of the river and its riparian areas that bear upon its ability to support an appropriate natural flora and fauna. This ability relates directly to the capacity of the system to provide a variety of goods and services.*

Different assessment methods are followed to assign an ecological category(see Table below) to each component. Ecological evaluation in terms of expected reference conditions, followed by integration of these components and assessed in terms of biological responses, represents the Ecological Status or Eco-Status of a river/stream.

Table 1: Ecological categories

Ecological Category	Description of the state of modification of the watercourse
A	Unmodified, natural.
B	Largely natural with few modifications. A small change in natural habitats and biota may have taken place but the ecosystem functions are essentially unchanged.
C	Moderately modified. Loss and change of natural habitat and biota have occurred, but the basic ecosystem functions are still predominantly unchanged
D	Largely modified. A large loss of natural habitat, biota and basic ecosystem functions has occurred.
E	Seriously modified. The loss of natural habitat, biota and basic ecosystem functions is extensive.
F	Critically / Extremely modified. Modifications have reached a critical level and the system has been modified completely with an almost complete loss of natural habitat and biota. In the worst instances the basic ecosystem functions have been destroyed and the changes are irreversible.

3. FINDINGS: PES AND EIS OF THE TWO SEASONAL WATERCOURSES

3.1 Present Ecological State

The 2013 PES reference condition (DWS) for the catchment X32 is Category C and the integrated EIS rating of the catchment area is Category D, based on the 2010 National Land Cover Assessment. Verification of the current land cover indicates extensive expansion of the surrounding urban settlement within the riparian zone of the two drainage lines downstream of the proposed development site. Figures 1 and 2 provides evidence and comparison of the 2009 and 2021 land cover.

Figure 1 Undeveloped project area 2009

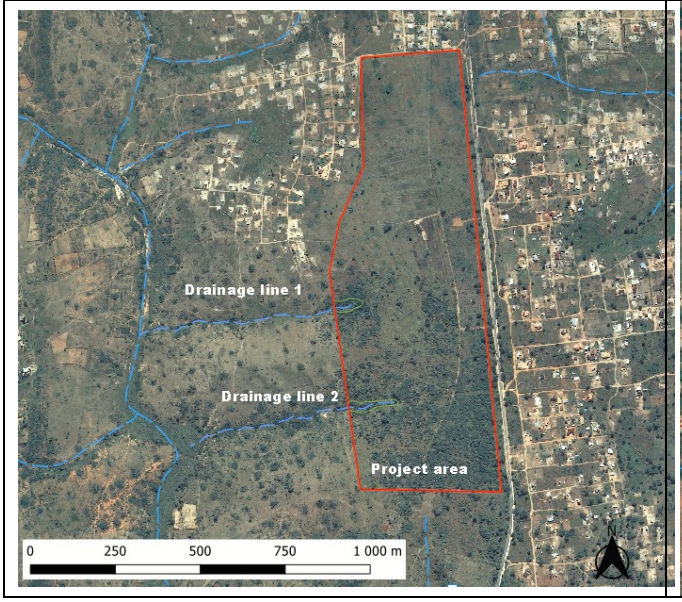
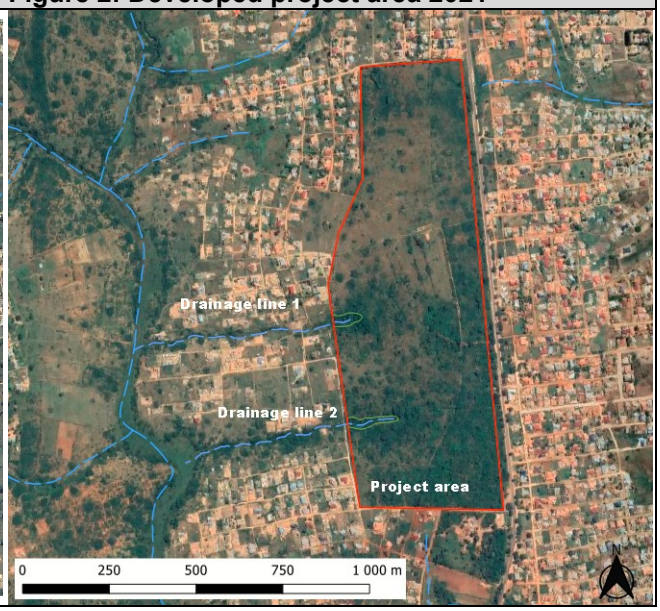


Figure 2: Developed project area 2021



It is clear from the above comparison that informal settlement along the drainage lines resulted in the serious altering of the beds and banks of the watercourse and major loss of the riparian zone. The project area was not impacted to the same extent as the surrounding urban area, however previous agriculture on the project site posed a negative impact on terrestrial and aquatic biodiversity which resulted in extensive bush encroachment by invader species.

Viewing Figures 1 and 2 it is clear that previous informal agriculture on the site and recent human settlement downstream of the site transformed the two drainage lines significantly and thus the PES andEIS values will also be influenced.

Table 2: PES comparison based on the 2010 and the 2021 land cover.

Parameter	Pre-2010	Current 2021
PES of the study area	Category C	Category D
PES of the surrounding area	Category C	Category E
PES of drainage lines in the study area	Category C	Category C/D
PES of the drainage lines downstream of the study area	Category C	Category E

Due to the added alien invading vegetation in the drainage lines of the project area, these habitats were degraded to a Category C/D, however further downstream of the project area, the surrounding impacts degraded these biotopes even further to a Category E (Largely modified).

Although major changes to the PES of the two drainage lines occurred over the past ten years it is not known if the PES of the Klein Sand River was affected during this period as such major study falls

outside the scope of this assessment and therefore PES Category C (Moderately transformed) as determined by DWS (2010) remains applicable.

3.2 Ecological Importance and Sensitivity Class (EISC)

Based on the findings of the PES of the two drainage lines, the "The Ecological Importance and Sensitivity Class (EISC)" of the project drainage lines are assessed as "Low" and the outcomes can be summarised as follow (abstracted from Table 3):

Table 3: Summary of Ecological Importance and Sensitivity Class (EISC) of the project drainage lines (based on the calculations of the EISC Model (see Table 4 below).

Parameter	Biota (riparian & instream)
Rare and endangered species	No rare or endangered species are expected along the drainage lines.
Unique (endemic, isolated, etc. species	No unique species are present.
Intolerant (flow & flow-related water quality)	Flow very sporadic and short-lived flow events; no aquatic species settle in drainage habitats.
Species/taxon richness	Flow very sporadic and short-lived flow events; no aquatic species settle in drainage habitats.
Riparian & instream habitats	
Diversity of types	Flow very sporadic and short-lived flow events; no instream habitats, only a small portion of riparian left intact.
Refugia	Flow very sporadic and short-lived flow events; no instream habitats available. Only a small portion of riparian left intact to act as refugia.
Sensitivity to flow changes	Flow very sporadic and short-lived flow events, few true riparian species not sensitive to flow changes.
Sensitivity to flow-related water quality changes	Flow very sporadic and short-lived flow events, no instream habitats available. Riparian species are not sensitive to water quality changes.
Migration route/corridor (instream & riparian)	Riparian corridor fragmented where housing development infringes on the riverine environment. No up-down-stream migration is expected.
Importance of conservation & natural areas	Very low
EISC Score	**LOW**

Table 4: MODEL The Ecological Importance and Sensitivity Class (EISC) of the project drainage lines.					
RIVER: Acorn City drainage lines **REACH/RU/IFR:**					
ECOLOGICAL IMPORTANCE AND SENSITIVITY CLASS (EISC)	**NATURAL**		**PRESENT**		**COMMENTS**
DETERMINANTS	**SCORE**	**CONFIDENCE**	**SCORE**	**CONFIDENCE**	
BIOTA (RIPARIAN & INSTREAM)	(0-4)		(0-4)		
Rare & endangered (range: 4=very high - 0 = none)	0,00	4,00	0,00	4,00	None expected
Unique (endemic, isolated, etc.) (range: 4=very high - 0 = none)	1,00	4,00	1,00	4,00	Tree clump
Intolerant (flow & flow related water quality) (range: 4=very high - 0 = none)	1,00	4,00	1,00	4,00	Marginal vegetation
Species/taxon richness (range: 4=very high - 1=low/marginal)	1,00	4,00	1,00	4,00	Very few species
RIPARIAN & INSTREAM HABITATS	(0-4)		(0-4)		
Diversity of types (4=Very high - 1=marginal/low)	1,00	4,00	1,00	4,00	Marginal
Refugia (4=Very high - 1=marginal/low)	1,00	4,00	0,00	4,00	Changed
Sensitivity to flow changes (4=Very high - 1=marginal/low)	0,00	4,00	0,00	4,00	None
Sensitivity to flow related water quality changes (4=Very high - 1=marginal/low)	1,00	4,00	1,00	4,00	Sediments washed down
Migration route/corridor (instream & riparian, range: 4=very high - 0 = none)	1,00	4,00	0,00	4,00	Riparian birds
Importance of conservation & natural areas (range, 4=very high - 0=very low)	not for natural	not for natural	0,00	4,00	Very low
MEDIAN OF DETERMINANTS	**1,00**		**0,50**		
ECOLOGICAL IMPORTANCE AND SENSITIVITY CLASS (EISC)	**LOW**		**LOW**		

WATERCOURSE BUFFER DETERMINATION

1. PROJECT INFORMATION

1.1	PROJECT NAME	Acorn City Mix Use Township
1.2	PROPERTY DESCRIPTION	Portion 27 of the farm Arthursseat 214-KU

2. WATERCOURSE BUFFER DETERMINATION TERMS OF REFERENCE / METHOD

The definitions of a buffer zone vary depending on its purpose. Buffer zones are used in land-use planning to protect natural resources and to limit the impact of one land use on another.

This project specifically looks at aquatic buffer zones which are typically designed to act as a barrier Between the proposed township development activities and two ephemeral water resources on the project site, thereby protecting them from adverse negative impacts.

Buffer zones associated with water resources have been shown to perform a wide range of functions, and on this basis, have been proposed as a standard measure to protect water resources and associated biodiversity (Macfarlane et al, 2015). These functions include:

- Maintaining basic aquatic processes;
- Reducing impacts on water resources from upstream activities and adjoining land uses;
- Providing habitat for aquatic- and semi-aquatic species;
- Providing habitat for terrestrial species; and
- A range of ancillary societal benefits.

Due to their positioning adjacent to water bodies, buffer zones associated with streams and rivers will typically incorporate riparian habitat. A riparian habitat as defined by the NWA, is commonly characterised by alluvial soils (deposited by the current river system) and are inundated or flooded to an extent and with a frequency sufficient to support vegetation or species with a composition and physical structure distinct from those of adjacent land areas(Macfarlane et al, 2015).

However, the riparian zone is not the only vegetation type that lies in the buffer zone as the zone may also incorporate stream banks and terrestrial habitats depending on the width of the aquatic impact buffer zone applied.

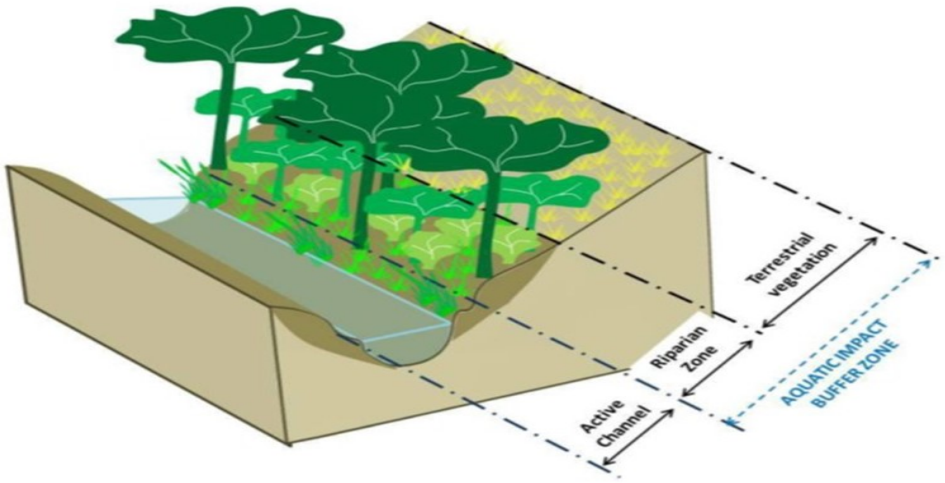
Once an aquatic impact buffer zone has been determined, management measures need to be tailored to ensure buffer zone functions are maintained for effective mitigation of relevant threat/s.

Management measures must therefore be tailored to ensure that buffer zone functions are not undermined. Aspects to consider include:

- Aquatic impact buffer zone management requirements;
- Management objectives for the aquatic impact buffer zone; and
- Management actions required to maintain or enhance the aquatic impact buffer zone in line with the management objectives. Activities that should not be permitted in the aquatic impact buffer zone should also be stipulated.

A diagram indicating how riparian habitat typically relates to aquatic buffer zones defined in this guideline is provided in Figure 1.

Figure 1: Schematic diagram indicates the boundary of the active channel and riparian habitat, and the areas potentially included in an aquatic impact buffer zone (Macfarlane et al, 2015).



Determining appropriate management and monitoring of buffer zones

A Buffer Zone Tools(Macfarlane and Bredin, 2017) has been developed to determine suitable buffer zone requirements. For purpose of this assessment, the Site Based rapid desktop tool for the determination of buffer zone requirements for river ecosystems, has been applied to the two drainage lines on the project site which is summarised in Table 1 of this report.

3. APPLICATION OF THE RIVER BUFFER DETERMINATION TOOL

The aspects required for determining a river buffer as incorporated in the Buffer Tool are Listed in Table 1 and the utilised to establish the riparian buffer zone of the Acorn City Project Area drainage line, are listed in Table 1 and the buffers obtained from these features are displayed at the end of the table as: 21 m during the construction phase, and 19 m for the operational phase.

Table 1: Site-based Tool: Determination of buffer zone requirements for river systems	
Name of Assessor	EAP
Project details	Acorn City Township
Date of Assessment	2021/12/17
STEP 1: DEFINE THE OBJECTIVE AND SCOPE & APPROPRIATE LEVEL OF ASSESSMENT	
Level of Assessment	Site-based
STEP 2: MAP AND CATEGORISE WATER RESOURCES IN THE STUDY AREA	
The approach used to delineate the riparian zone & active channel?	Site-based delineation
River type	Headwater stream (upper mid-slope terrain unit)
STEP 3: DWS MANAGEMENT OBJECTIVES FOR THE MAPPED WATER RESOURCES	
Present Ecological State	E (Seriously modified. The loss of natural habitat, biota and basic ecosystem functions is extensive).
Ecological importance & sensitivity (Current status)	Very Low: Seriously modified. The loss of natural habitat, biota and basic ecosystem functions is extensive.
Management Objective	Maintain

Continue overleaf

STEP 4: ASSESS THE RISK OF THE DEVELOPMENT AND DEFINE MITIGATION MEASURES			
Assess threats of planned activities on water resources and determine desktop buffer requirements			
Sector	Civic and Social: This category includes buildings and land associated with public and private service providers and administrative or government functions including education, health, pension offices, museums, libraries, correctional facilities and community halls.		
Sub-sector	Civic and Social		
Climatic factors			
MAP Class	>800-1000		
Rainfall intensity	Zone 4		
The threat posed by the proposed land use / activity during the construction phase			
Threat Posed by the proposed land use / activity	**Desk-top threat rating**	**Specialist threat rating**	**Justification for changes in threat ratings**
1. Alteration to flow volumes	VL	Low	Temporary stormwater management measures will be incorporated in the EMP.
2. Alteration of patterns of flows	Low	Low	Temporary stormwater management measures will be incorporated in the EMP
3. Increase in sediment inputs & turbidity	High	Medium	Mitigation measures of minimum site disturbance as indicated in the EMP to be applied during construction.
4. Increased nutrient inputs	Very Low	Low	
5. Inputs of toxic organic contaminants	Very Low	Low	
6. Inputs of toxic heavy metal contaminants	Low	Low	There will be no disposal of heavy metal wastes, paints, pesticides or fertilisers on site.
7. Alteration of acidity (pH)	N/A	Low	Minimum site disturbance as indicated in the EMP to be applied during construction.
8. Increased inputs of salts (salinization)	N/A	N/A	
9. Change (elevation) of water temperature	Very Low	Very Low	
10. Pathogen inputs	Very Low	Very Low	
Threat posed by the proposed land use / activity during the operational phase			
1. Alteration to flow volumes	Medium	Medium	Storm water concentration will alter flow volumes, however storm water detention ponds will mitigate altered flow volumes.
2. Alteration of patterns of flows	High	Medium	Natural drainage will be altered by storm water management systems but will be buffered by storm water detention pond.
3. Increase in sediment inputs & turbidity	Low	Low	Storm water detention pond will trap turbidity.
5. Increased nutrient inputs	Low	Low	Storm water detention pond will trap nutrients.
5. Inputs of toxic organic contaminants	Low	Low	Storm water detention pond will trap organic contaminants.
6. Inputs of toxic heavy metal contaminants	Very Low	Very Low	
7. Alteration of acidity (pH)	Very Low	Very Low	
8. Increased inputs of salts (salinization)	Low	Low	
9. Change (elevation) of water temperature	Low	Low	
10. Pathogen inputs	Low	Low	

Continue overleaf

Assess the sensitivity of water resources to the treats posed by lateral land-use impacts.	
Stream order	1st order
Channel width	1 – 5m
Perenniality	Intermittent systems (<3 months)
Average slope of rivers catchment	9-11%
Inherent runoff potential of the soil in the river's catchment	Low- Moderate (B)
Longitudinal river zonation	Upper Foothills
Inherent erosion potential (K factor) of catchment soils	0.2
Retention time	General free flowing
Inherent level of nutrients in the landscape	Low to Moderate base status (Dystrophic & mesotrophic)
Inherent buffering capacity	Neutral pH
Natural salinity levels	Non-saline (<200mS/m)
River depth to width ratio	< 0.25
Mean annual temperature	Zone 5 (19.5 -24.2 ºC)
Level of domestic, livestock and contact recreational use	Low

Assess the sensitivity of biodiversity elements to threats poses by lateral land-use impacts		
Threat Posed by the proposed land use / activity	**Constriction Period Site-Based Risk Class**	**Operational Period Site-Based Risk Class**
1. Alteration to flow volumes	Low	Medium
2. Alteration of patterns of flows (increased flood peaks)	Low	Medium
3. Increase in sediment inputs & turbidity	Medium	Low
6. Increased nutrient inputs	Low	Low
5. Inputs of toxic organic contaminants	Low	Low
6. Inputs of toxic heavy metal contaminants	Low	Low
7. Alteration of acidity (pH)	N/A	Very Low
8. Increased inputs of salts (salinization)	N/A	Low
9. Change (elevation) of water temperature	Very Low	Low
10. Pathogen inputs (i.e. disease-causing organisms)	Very Low	Low

Refine desktop buffer requirements based on on-site investigations	
Slope of the buffer	Moderate (10.1 - 20%)
Vegetation characteristics (Construction phase)	Poor: Vegetation either short (<5cm) (e.g., maintained lawns) or robust but widely spaced plants with poor interception (e.g., trees or shrubs with poorly vegetated understory).
Vegetation characteristics (Rehabilitation phase)	Good : Moderately robust vegetation with good inception potential
Soil permeability	Moderate Deep moderately textured soils (e.g. sand & loam) OR shallow (<30cm) well drained soils.
Micro-topography of the buffer zone	Dominantly uniform topography: Dominantly smooth topography with some few/minor concentrated flow paths (i.e. erosion gullies, drains) that will reduce interception.

Site-based aquatic impact buffer requirements	
Construction Phase	**21 meters**
Operational Phase	**19 meters**
Final aquatic buffer requirement	**21 meters**

In order to protect the drainage lines in their current condition from any degradation, a buffer of 21 m wide on both sides of the drainage line is required. This buffer width is obtained whenever the following mitigation measures are applied to the model (Table 2).

Table 2: Applicable mitigation measures that applies to the model	
Threat Posed by the proposed land use / activity	**Justification for changes in threat ratings**
Construction Phase	
1. Increase in sediment inputs & turbidity	Incorporate all necessary erosion control and siltation preventative measures around the drainage lines.
Operational Phase	
2. Alteration to flow volumes	Second buffer - Proposed vegetated green belts incorporating open storm water channels according to appropriate sustainable storm water design.
3. Alteration of patterns of flows (increased flood peaks)	First buffer – proposed on-site surface runoff containment around buildings & parking areas (architectural and landscaping).
4. Increase in sediment inputs & turbidity	Third buffer - Storm water retention ponds; Fourth buffer - Storm water retention berms to prevent run-off onto lower lying properties.
5. Inputs of toxic organic contaminants	Bio-filtration strip contour lines.

4. RECOMMENDATIONS

4.1 The buffer area as determined and indicated on Figure 2 must be incorporated within an “open space” erf within the proposed township.

4.2 With reference to the low PES and EIS of the watercourse the following urban infrastructure can be allowed to be planned and installed within and across both drainage line both drainage lines and within the aquatic buffer area:

- A dam wall for a storm water attenuation pond within the lower section of the drainage line near to the western boundary of the property.
- An outlet structure for the storm water attenuation pond.
- Gabion structures within the bed of the drainage line as part of storm water attenuation and erosion prevention.
- Culvert-type watercourse crossing for a future urban street across the drainage line along the western boundary of the property, integrated with the storm water attenuation pond.
- The above structures must be adequately designed as to prevent any flooding and soil erosion downstream of the property.
- In addition at drainage line “2”, infilling for an urban street with 16m road reserve within the uppermost section of the drainage line.
- The mitigation measures to buffer flow volumes, and to decrease sediment inputs, toxic contaminants and turbidity must be applied in the storm water management plan.

4.3 The maintenance requirements of the drainage lines, buffer area and mitigation measures must be incorporated in an environmental management plan as part of the operational maintenance of the township.

Figure 2: This figure outlines the proposed buffer of 20m (yellow line) as determined in Table 1.

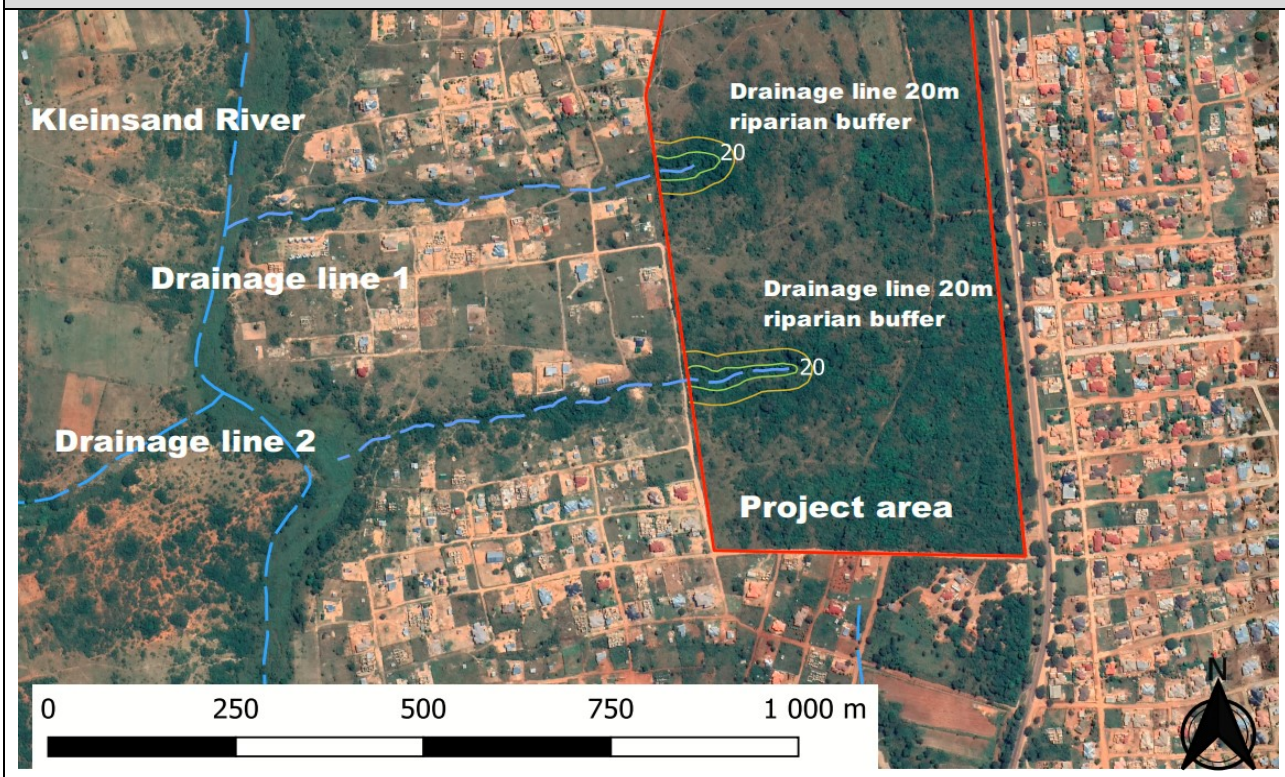


Figure 3: Allowable infrastructure to be installed within the drainage lines and buffer zones.

WATERCOURSE RISK ASSESSMENT

1. PROJECT INFORMATION

1.1	PROJECT NAME	Acorn City Mixed Use Township
1.2	PROPERTY DESCRIPTION	Portion 27 of the farm Arthursseat 214-KU

2. TERMS OF REFERENCE / METHOD FOR WATERCOURSE RISK ASSESSMENT

A watercourse risk assessment protocol for activities that will lead to *impeding or diverting of flow or altering the bed, banks, course or characteristics of a watercourse* is prescribed in DWS 2015 publication: Section 21 (c) and (I) water use Risk Assessment Protocol and as contained in Appendix A in GN509 of 26 August 2016)

The following Guidelines as used in the risk assessment protocol:

(a) A Practical Field Procedure for Delineation of Wetlands and Riparian Area (2005) which is available on the Department's website http:/ /www.dws.gov.za, under water use authorization in terms of section 21 (c) or (i) of the Act;

(b) Appendix A (Excel Spreadsheet) and information regarding the method used in Appendix A is contained in the Department of Water and Sanitation 2015 publication: Section 21(c) and (i) water use Risk Assessment Protocol, which is available on the Department's website http: / /www.dws.gov.za, under section 21(c) and (i) water use authorization.

(c) Guideline: Assessment of activities /developments affecting wetlands, which is available on the Department's website http: / /www.dws.gov.za, under section 21 (c) and (i) water use authorization.

(d) Guideline for the determination of buffer zones for rivers, wetlands and estuaries, which is available on the Department's website http: / /www.dws.gov.za, under water use authorization in terms of section 21 (c) and (i) of the Act.

The Risk Rating Formula is prescribed in the Regulations as follows:

- Consequence= Severity + Spatial Scale + Duration
- Likelihood = Frequency of the Activity+ Frequency of the Impact + Legal Issues + Detection
- Risk = Consequence x Likelihood

and is applied in Tables 1-5 below.

3. RISK RATING USED IN MODEL

Table 1: Severity - How severe do the aspects impact on the resource quality (flow regime, water quality, geomorphology, biota, and habitat)? Derived from the DWS Risk Matrix Impact Assessment method (GN 509).	
Insignificant / non-harmful	1
Small / potentially harmful	2
Significant / slightly harmful	3
Great / harmful	4
Disastrous / extremely harmful and/or wetland(s) involved	5
Where "or wetland(s) are involved" it means that the activity is located within the delineated boundary of any wetland. The score of 5 is only compulsory for the significance rating.	

Table 2: Spatial scale - How large is the area that the aspect is impacting on? Derived from the DWS Risk Matrix Impact Assessment method (GN 509).	
Area specific (at impact site)	1
Whole site (entire surface right)	2
Regional/neighbouring areas (downstream within quaternary catchment)	3
National (impacting beyond secondary catchment or provinces)	4
Global (impacting beyond SA boundary)	5

Table 3: Duration -How long does the aspect impact on the resource quality? Derived from the DWS Risk Matrix Impact Assessment method (GN 509).	
One day to one month, PES, EIS and/or REC not impacted	1
One month to one year, PES, EIS and/or REC impacted but no change in status	2
One year to 10 years, PES, EIS and/or REC impacted to a lower status but can be improved over this period through mitigation	3
Life of the activity, PES, EIS and/or REC permanently lowered	4
More than life of the organisation/facility, PES and EIS scores, a E or F	5
PES and EIS (sensitivity) must be considered.	

Table 4: Frequency of the activity - How often do you do the specific activity? Derived from the DWS Risk Matrix Impact Assessment method (GN 509).	
Annually or less	1
6 monthly	2
Monthly	3
Weekly	4
Daily	5

Table 5: Frequency of the incident/impact - How often does the activity impact on the resource quality? Derived from the DWS Risk Matrix Impact Assessment method (GN 509).	
Almost never / almost impossible / >20%	1
Very seldom / highly unlikely / >40%	2
Infrequent / unlikely / seldom / >60%	3
Often / regularly / likely / possible / >80%	4
Daily / highly likely / definitely / >100%	5

Consequence	Severity + Spatial Scale + Duration
Likelihood	Frequency of the Activity+ Frequency of the Impact + Legal Issues + Detection
RISK RATING	Consequence x Likelihood

Table 6: Risk Assessment Matrix for the Acorn City project area relating to all current and expected impacts that the project may pose on the river system, the significance of these impacts, and mitigation through control measures.

Activity	Aspect	Potential Impact	Significance	Risk Rating	Without mitigation	Confidence level	Control Measures
Erosion and siltation: Clearing areas, topsoil stripping and grubbing during construction of the areas for the mixed-use development around the drainage lines.	Removal of vegetation and topsoil.	Vegetation clearing (exposed soil surfaces) may alter the hydrological nature of the area by increasing the surface run-off velocities.	**40,5**	**Low**	**Moderate**	**3**	It is best to plan preconstruction and construction during the driest time of the year. All clearing and construction methods should be developed with this risk in mind. Construction time should be kept as short as possible, and planting or rehabilitation of cleared or excavated areas (excluding storm water retention ponds) should commence as soon as the development activity is completed. Areas susceptible to erosion must be protected by installing appropriate temporary or permanent drainage works and water energy dispersion structures.
		Where vegetation is cleared, compaction takes place (access roads, paths, trampling). Compaction of surfaces reduce the potential for any run-off to infiltrate into the soils.	**40,5**	**Low**	**Moderate**	3	All soils compacted as a result of construction activities in the project footprint areas should be ripped and profiled. Terraces should be established which will slow runoff and enhance infiltration in the groundwater and contribute to sub-surface flows. Ridges are to be constructed along contour lines to avoid erosion and slow surface runoff on slopes.
		Where hard surfaces are created, it escalates the potential for erosion and sedimentation to occur.	**40,5**	**Low**	**Moderate**	3	The EO / ECO will specify a solution in terms of the most appropriate approved method and technology to stabilise slopes. One or more of the following methods may be required: • Topsoil covered with a geotextile, plus a specified grass seed mixture. • A 50:50 by volume rock:topsoil mix 200mm thick, plus specified grass seed mixture. • Logging or stepping (logs placed in continuous lines following the contours). • Earth or rock-pack cut-off berms. • Benches (sand bags). • Packed branches. • Ripping and / or scarifying along the contours. • Storm water berms.
Clearing areas, topsoil stripping and grubbing during construction of bio-filtration pits and storm water retention ponds,	Removal of vegetation in drainage lines	Clearing vegetation can result in the loss of various plant species including those of conservation concern.	26	Low	Low	4	Identify and demarcate the extent of the drainage line sites and associated Works Areas using danger tape with steel droppers. In sensitive environments, or where access into no-go areas takes place, then a perimeter fence must be erected around the works area, the specification of which must be adequate to address the problem. Maintain site demarcations in position until the cessation of construction works. Do not paint or mark any natural feature. Marking for surveying and other purposes must be done using pegs, beacons or rope and droppers. Identify, locate and map all plants and natural features to be protected during construction.

Impacting on the core habitat of the drainage lines and the receiving environment of the Klein Sand River.	Biodiversity conservation management measures need to be taken into consideration when determining management measures for core habitats and corridors.	Impacts on water resources from upstream activities and adjoining land uses.	**42,5**	**Low**	**Moderate**	4	Introduce the 20m buffer zone to protect the water course. This buffer should be implemented, demarcated and strictly adhered to. It should be maintained as an extension of the natural riparian zone and natural, indigenous vegetation should be planted to improve its buffering capacity.
	Storm water runoff: Compaction of soil (Hardening of surfaces and other forms of impervious exteriors) results in concentrated storm water runoff volume and velocities.	The typical categories of problems that arise in the immediate catchment areas are: reduced infiltration and water-table recharge, resulting in enhanced flooding,	**45**	**Low**	**Moderate**	**3**	Strict measures must be taken to prevent erosion and sediment-laden water from entering the adjacent watercourses from the extensive area of surrounding development. These measures should include: • minimising the clearing areas and the removal of topsoil, stockpiling, covering and reuse of topsoil where re-establishment of vegetation on cleared areas is possible, • re-establishment of indigenous vegetation wherever possible (particularly where riparian zones have been disturbed for watercourse crossings by fence line, pipeline or roads), • Control of stormwater run-off (in accordance with a stormwater management plan) and ongoing repair and stabilisation of any erosion. Additionally, in the instance of excessive surface run off volumes, surface water flow could be discharged into grassed retention swales to decrease the velocity and volume of water which may potentially enter the watercourses.
		The typical categories of problems that arise in the drainage lines are: erosion and associated channel widening and streambed alteration, bank collapse and ongoing loss of riparian vegetation habitats.	**45**	**Low**	**Moderate**	**3**	In the event that soil erosion does occur, each case should be managed in as practicable way as possible. The point of stormwater release is to be stabilised to prevent the stream from being further scoured/eroded. In any areas where the risk of erosion is evident, appropriate temporary or permanent works and water energy dispersion structures must be installed. Re-vegetation of disturbed surfaces should occur immediately after the construction activities are completed. In the case of Acorn City development, a site plan for the storm water plan and special mitigation proposals were developed. These measures include: • First buffer – proposed on-site surface runoff containment around buildings and parking areas (architectural and landscaping). • Second buffer - Proposed vegetated green belts incorporating open storm water channels according to appropriate sustainable storm water design (engineering and landscaping design). • Oil separator and/optional bio-filtration pit at potential run-off contamination sites/points. •Bio-filtration strip Contour lines.

							• Third buffer - Storm water retention ponds (less than 50000 cubic metres) that incorporate the function of storage of treated sewer for re-use on gardens and sport fields. Two smaller ponds in series may be better than one large pond. • Ameliorated storm water runoff towards natural streams.
		The typical categories of problems that arise in the Klein Sand River receiving environment are: erosion of riverbeds, sedimentation, as well as loss of aquatic habitats and thus the changes to the overall river ecology.	**45**	**Low**	**Moderate**	**3**	Limited disturbance to the bed and banks of the Klein Sand River during the construction process. As an additional anti-sedimentation precaution, shallow trenches, grassed lateral drains or mitre drains (draining at 45°) should be considered in higher risk areas along access tracks, on the river side, before run-off enters the buffer areas and/or watercourses. Ameliorated storm water runoff towards natural streams proposed in the storm water plan for the site, will assist in mitigating the runoff issue.
		Fire management.	**34**	**Low**	**Low**	**3**	Any work that requires the use of fire may only take place at a designated area approved by the ER and must be supervised at all times. Fire-fighting equipment shall be available. The drainage line source bush clumps and riparian zone should be protected against fire damage during construction and operation.
		Grazing management - trampling of drainage line wetlands.	**36**	**Low**	**Low**	**3**	Cattle should be excluded from the drainage line source bush clumps and riparian zone. If needed the drainage lines and associated buffers should be fenced off if cattle are allowed to enter the Acorn City property.
Employee management	Harvesting and/or poaching in the existing natural areas, especially in the drainage line woodclumps and riparian zones.	Removal of medicinal plants, fire wood from thicket and/or wildlife. Incidental animal finds and deliberate acts of poaching will impact locally occurring fauna	**28**	**Low**	**Low**	**4**	Create awareness of nature conservation designations, protected species or habitats that might be adversely affected by the works. No wild animal may under any circumstance be handled, removed or be interfered with. No wild animal may be fed on site. No wild animal may under any circumstance be hunted, snared, captured, injured or killed. This includes animals perceived to be vermin. No fire wood should be collected, especially not in the drainage wood clumps.
					Low		
Alien and invasive species management in drainage lines.	Alien invasive plant recruitment	The removal of indigenous wetland species predisposes the disturbance footprint to alien plant invasion. Competing with indigenous plant species and further	**49,5**	**Low**	**Moderate**	**4**	Control exotics and invasive plants to be eradicated. Following the completion of any works, the water user must ensure that all disturbed areas are: (i) cleared of alien invasive vegetation; (ii) re-vegetated with indigenous and endemic vegetation suitable to the area. Control involves killing the plants present, killing the seedlings which emerge, and

		transform the natural habitat.					establishing and managing an alternative plant cover to limit re-growth and re-invasion. Dispose of the eradicated plant material at an approved solid waste disposal site. Rehabilitate all identified areas as soon as practically possible, utilising specified methods and species. Chemical eradication: Ensure that only properly trained people handle and make use of chemicals. Follow manufacturer's instruction when using chemical methods, especially in terms of quantities, time of application etc. Monitor all sites disturbed by construction activities for colonisation by exotics or invasive plants and control these as they emerge. Introducing alien fish species must be prohibited.

4. RISK ASSESSMENT FINDINGS AND RECOMMENDATIONS

4.1 Table 6 indicates that 8 out of 12 risks around the drainage lines will have to be mitigated to render it to a **"Low" Risk Rating**. The important impacts are those concerning with erosion and siltation, and storm water management.

4.2 A very important aspect is the management of storm water. It is predicted that compaction of soil and hardening of surfaces due to paved surfaces, will concentrate and thus increase stormwater releases into the drainage lines. The unnatural increase of flows in these natural drainage systems will certainly have adverse impacts on the receiving environment (the drainage lines and Klein Sand River), as well as the recent township development up to the edge of the drainage lines.

4.3 In order to prevent damage to the morphology of the drainage systems and to homestead infrastructure, a site plan for the storm water plan and special mitigation proposals were developed. These measures include:

- On-site surface runoff containment around buildings and parking areas.
- Vegetated green belts incorporating open storm water channels.
- Oil separator and/optional bio-filtration pits.
- Bio-filtration strips on contour lines.
- Storm water retention ponds.
- Ameliorated storm water runoff.

4.4 As such, some of these measures will involve clearing of areas, construction inside the buffer area and also damming of water in the drainage lines. Should these structures be assessed as development as such, not all of them might have come out with "Low" Risk Ratings. However, due to the fact that they are mitigating an even larger risk, renders them "Low" and a benefit to the system.

5. CONCLUSION

All the expected impacts were assessed and all were confirmed to be "Low" or mitigated to attain a "Low" risk level. By implementing all the mitigation measures and managing the system on a continuous basis as prescribed by the Risk Assessment, all the impacts will be addressed to a satisfactory level. Therefore, it is proposed that the project should be authorised with the provision that the mitigation measures prescribed in this document, where applicable, are included in the EMPr